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# POPULAR COMPUTING®

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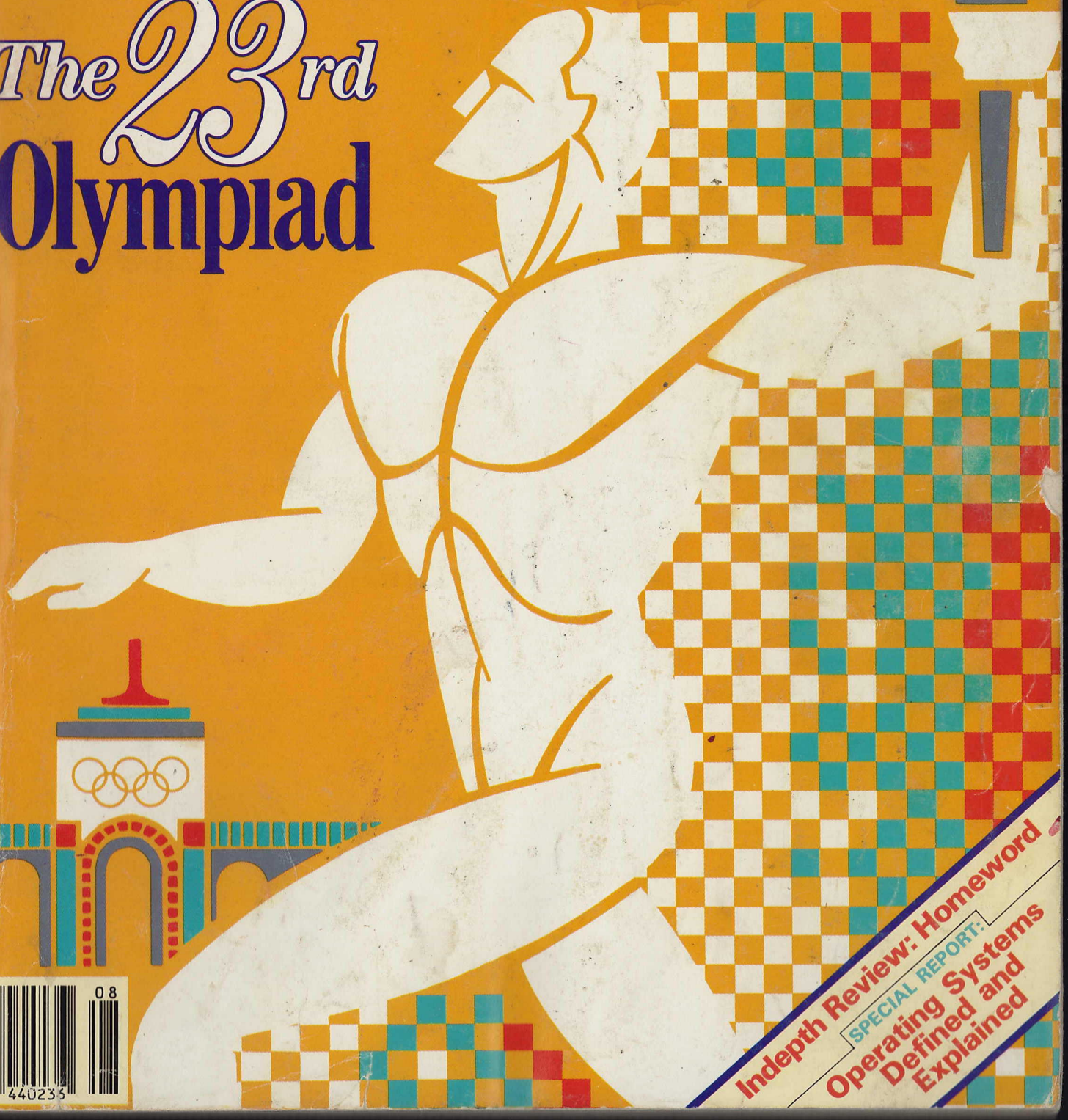
## COMPUTERIZING The 23rd Olympiad



SPECIAL REPORT:
Operating Systems Defined and Explained

Indepth Review: Homeword

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POPULAR COMPUTING □ AUGUST 1984 □ Vol. 3 No. 12

# HOW TO PICK A PRINTER:

## (A survivor's guide.)

**WRITE DOWN WHAT YOU NEED ONE FOR IN THE FIRST PLACE.**

And then the second place. And third place (Letters to customers, newsletters, financial reports, etc.). In other words, set down your priorities, in black and white—which will go a long way toward keeping you out of the red. Because the price of a printer is almost directly proportional first to the quality of its printing, and second to how fast it prints.

**THERE ARE TWO KINDS OF PRINTERS IN THIS WORLD. CHOOSE ONE.**

Either "letter-quality," which gives you text that you can't tell from hand-typed copy . . . or "dot-matrix," which, with a C. Itoh printer, looks like this. (Most other dot-matrix, or "business printers" have a far flimsier dot pattern, and give you copy that looks like a bad job of spray painting.) The former is for formal: reports to clients, final drafts of boilerplate, contracts, or letters to the President.

It prints with easily available "daisy wheels," similar to those on many typewriters. It's the "show" part of Show and Tell and its price reflects it.

Letter-quality printers generally cost about a grand more than their dot-matrix counterpart. Dot-matrix printers are made for the "tell" functions: things like financial data, interoffice memos, authors' first drafts, or "dumping" a bunch of programming data onto hard copy for reference or de-bugging.

Not fancy, but functional. And, comparatively, cheap.

**FIGURE OUT HOW FAST YOU NEED WHAT.**

Because the higher the speed, the higher the price—typically several hundred bucks per significant speed jump. (About speed: It's measured in "cps," or "characters per second.") A standard business letter contains about 1,000 characters. So, at 18 cps, it takes about a page per minute to print.

Therefore, you have to ask yourself if it's worth an extra $500 to double the speed with another letter-quality printer. If you churn out lots of copy, the answer is probably yes; if you grind out only a dozen letters a day, it's probably no.

**UNDERSTAND THIS: WITH ANY BRAND OF PRINTER, YOU GET WHAT YOU PAY FOR.**

If you buy a Brand-X printer for $1,000, it's going to be better or faster or somehow gooder than the same brand that costs $500.

In the case of the C. Itoh line of printers, the same holds true. Even though we promise that at every price point you're getting the very highest value for the very lowest buck. By a long shot.

And that's a gross understatement.

**BEWARE THE BRAND, THE WARRANTY, AND THE SERVICE.**

No printer is perfect. (At least not forever.)

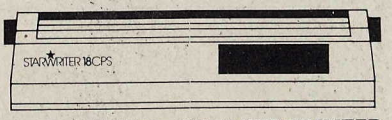
Which is why most other brands come with a 90-day warranty, a service policy that requires a lawyer, and a repair department in Des Moines or someplace.

Nor do we claim perfection. But every C. Itoh printer is backed by a full-year warranty.

Check the chart (opposite). And if you still have questions, we still have people with answers. Call toll-free.

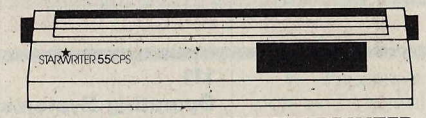
# WHICH PRINTER TO PICK:

## (A survivor's friend.)

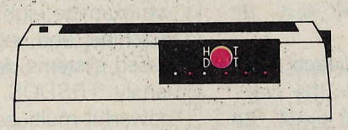



**18 CPS LETTER-QUALITY PRINTER**

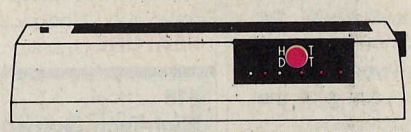
**40 CPS LETTER-QUALITY PRINTER**




**55 CPS LETTER-QUALITY PRINTER**

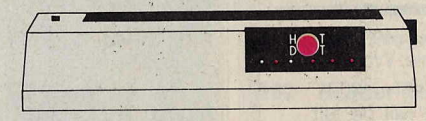


**180 CPS DOT-MATRIX PRINTER**

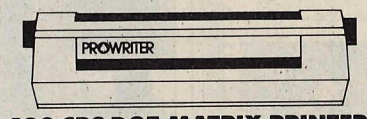


**WIDE-CARRIAGE 180 CPS DOT-MATRIX PRINTER**

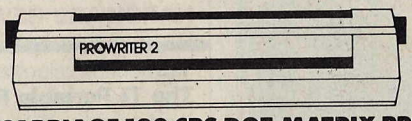
**180 CPS COLOR DOT-MATRIX PRINTER**



**WIDE-CARRIAGE 180 CPS COLOR DOT-MATRIX PRINTER**




**120 CPS DOT-MATRIX PRINTER**




**WIDE-CARRIAGE 120 CPS DOT-MATRIX PRINTER**

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# POPULAR COMPUTING

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**The Micro Revolution** by Jerry Pournelle—Should you just sit back and leave programming to the pros? If you do, warns our micro maven, you'll never know the real meaning of the term *personal* computer.

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## SPECIAL REPORT: OPERATING SYSTEMS


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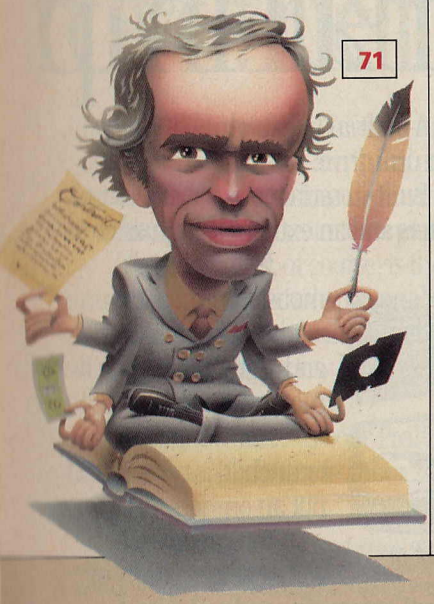



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Illustration by John Martinez

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# Announcing a small imp

It's 12″ x 11¼″ x 2¼″.
It weighs less than 8 pounds.*
And costs less than $1,300.**
Yet with 128K, the new Apple® IIc Personal Computer is a lot bigger than it looks.

*The IIc has a full-size keyboard.*

Because it's inherited all the talents of the eminently talented Apple IIe:

The versatility to run over 10,000 different software programs.

The ironclad reliability of the first true VLSI motherboard.

And the artistic ability of 16 high-resolution colors.

The IIc also has some talents of its very own.

For instance, a switchable 80/40-character display.

Switchable QWERTY/Dvorak keyboard.

A built-in half-high 143K single-sided disk drive.

Built-in serial ports for modems, printers and an extra half-high drive.

Even built-in mousetronics so it's ready to use a mouse and all the new Apple II mouseware.

And our newest brainchild is certainly not an orphan.

You can grow it with a whole family of Apple II accessories and peripherals.

*Thin, isn't it? Even with its built-in disk drive.*

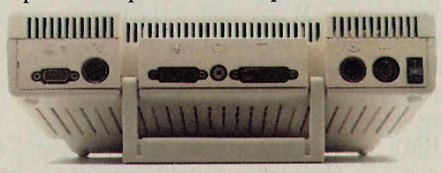
# rovement on the Apple IIe.

Including the new Apple Scribe—Apple's first full-color print-on-anything printer for under $300, it can handle anything from business graphics to term papers.

The IIc's father, of course, is the granddaddy of the whole personal computer industry, the Apple IIe. Which, lest we forget, has quite a few improvements of its own this year.

The IIe can now use our ProFile™ hard disk—so it can store about 2400 pages of anything you'd like to remember.

And the Apple IIe is still the most expandable personal computer there is.



*Built-in ports for making all the right connections.*

You can increase its RAM to an elephantine 512K. Add a Z-80 card to run CP/M.™

In fact, you can grow it with enough cards and peripherals to run just about any family business. Like Saudi Arabia.

So you see, the only question is whether you need an expandable Apple II. As in IIe.

Or a compact Apple II. As in IIc.

Just visit your friendly authorized Apple dealer.

And tell them what size improvement you'd like.

** Don't asterisks make you suspicious as all get-out? Well, all this one means is that the IIc CPU alone weighs 7.5 pounds. The power pack, monitor, an extra disk drive, a printer and several bricks will make the IIc weigh more. Our lawyers were concerned that you might not be able to figure this one out for yourself. ** The FTC is concerned about price-fixing. So this is only a Suggested Retail Price. You can pay more if you really want to. Or less.* *© 1984 Apple Computer, Inc. Apple, the Apple logo and ProFile are trademarks of Apple Computer, Inc. CP/M is a trademark of Digital Research Inc.*

*For an authorized Apple dealer nearest you, call* ***(800) 538-9696.*** *In Canada, call* ***(800) 268-7796*** *or* ***(800) 268-7637.***

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# IBM Responds

*Dear Ms. Clark:*

*Your April editorial, "The Responsibility of Leadership," contains inaccuracies and is misleading in a number of ways.*

*Your claim that IBM "forestalled the introduction of upgrades and new products" is untrue and ignores the company's responsibility not only to design new products, but to ensure that those products are built with the highest levels of quality, reliability and economy. We believe no company in the industry has contributed more significant technological "firsts" than IBM.*

*In characterizing IBM as being on a "predatory prowl," you ignore the fact of intense competition in all sectors of a very dynamic industry. There is ample opportunity for many companies to prosper and there are many who have in the past and many who will succeed in the future.*

*Finally, in describing the IBM PCjr as a "deliberately crippled machine," you misrepresent that product's quality, innovation, and performance. For example, the PCjr's keyboard is a full-travel keyboard with the same tactile pressure as the IBM PC's. Its 62-key design is simple to learn and less intimidating to new users than a larger keyboard. The PCjr keyboard is fully programmable and has all functions of the IBM PC keyboard. There is no inherent limitation on memory capacity compared to the IBM PC. In fact, a number of companies have announced products to take advantage of this attribute—much as they did following the introduction of the IBM PC. The PCjr system price includes enhanced color, graphics, and sound capabilities over the IBM PC. Contrary to your view that the PCjr disregards "consumers' real needs," we believe it directly meets those needs with outstanding price/performance and innovative design.*

*Philip D. Estridge*
*President, Entry Systems Division*
*IBM, Boca Raton, Florida*

Although I have no desire to flog a dead issue, this letter from Phil Estridge is so intriguing that I'm forced to tackle the PCjr once again.

Mr. Estridge, as much as I would love to claim sole credit for identifying the shortcomings of IBM's leadership, I must admit that my viewpoints on the specifics of the issues are shared by a vast number of others. Regarding the claim that IBM forestalled the introduction of upgrades and new products, a number of books that discuss the history of IBM support that fact. Readers wanting more detailed information about IBM's business practices might begin with *The Computer Establishment* by Katherine Davis Fishman.

Second, my phrase "predatory prowl" does describe the attitude of IBM in an age of competitiveness. Many vendors feel, rightly or wrongly, that with the purchase of 20% of Intel, IBM got an unfair advantage in the allocation of 8088 chips. Yes, many companies will prosper, as will IBM. However, to quote a report from International Resource Development Inc., "IBM, streamlined and free of the fetters imposed on it for so long by the now-dropped Justice Department antitrust suit, is playing Mr. Nice Guy to no one." In "How to Compete with IBM" (February 6, 1984) *Fortune* reported: "Taking on IBM is different from competing with the leader in most other industries. It inspires a special kind of fear."

As to your concern about my view that the PCjr is "deliberately crippled," dealers, industry watchers, and end users have all pointed fingers at IBM for failing to deliver what consumers need. *Electronic News* (April 2, 1984) reported that "businessmen are discouraged by the lack of a professional-type keyboard. The success of PCjr as a business machine is also hampered by limitations in memory and disk drive capacity." As evidence, look at the sales of the PCjr. According to *PC Week* (March 27, 1984), "IBM's PCjr, anticipated with such high expectations, is selling so poorly that some dealers say they won't reorder." The *Stinson Report*, a market research letter, reported (March 12, 1984) that PCjrs are gathering dust on dealers' shelves.

We believe that IBM's response to both the criticism and customer disinterest in the PCjr will not end with letters to the editor. In the volatile consumer marketplace, Big Blue may find it necessary to introduce a "new and improved" version for under $1000. If giants can respond to real computing needs, there may be hope for us users yet. Pamela Clark

**From high in the moonlit sky comes the urgent call for help.**

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*This is A-66253. I need help."*

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# The new IBM DisplayWrite

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*Prices apply at IBM Product Centers and may vary at other stores.

**Available in July, 1984.

# Series is here. Spread the word.

In 1980, IBM introduced the Displaywriter System. Today, it's become the best-selling stand-alone text processor in the world. One reason for this success is the Displaywriter's function-rich software.

If you're looking for software like that, but working on an IBM personal computer, you don't have to look any further. Because the IBM DisplayWrite Series is here.

And it will put many of the features and capabilities of a dedicated word processor to work for you when you're writing.

## *It runs in the family.*

You'll find two word processing programs in this series: There's DisplayWrite 1, for IBM personal computers—including PC*jr.* And DisplayWrite 2, with added functions for your PC, PC/XT or *Portable* PC.

You'll also find DisplayWrite Legal, a dictionary of about 16,000 words that a lawyer might need to check.

And you'll find DisplayComm, which lets your IBM PC send and receive text to and from other IBM PCs. If you're writing at the office, this program could also let you send text to an IBM Displaywriter down the hall. (From there, it could be sent on to an IBM host computer for distribution.)

## *Some words on high function.*

The DisplayWrite word processing programs give you the time-saving features you'd expect from IBM. Justified margins, centered lines and pagination, for example. You'll even have prompts and messages to help guide you along.

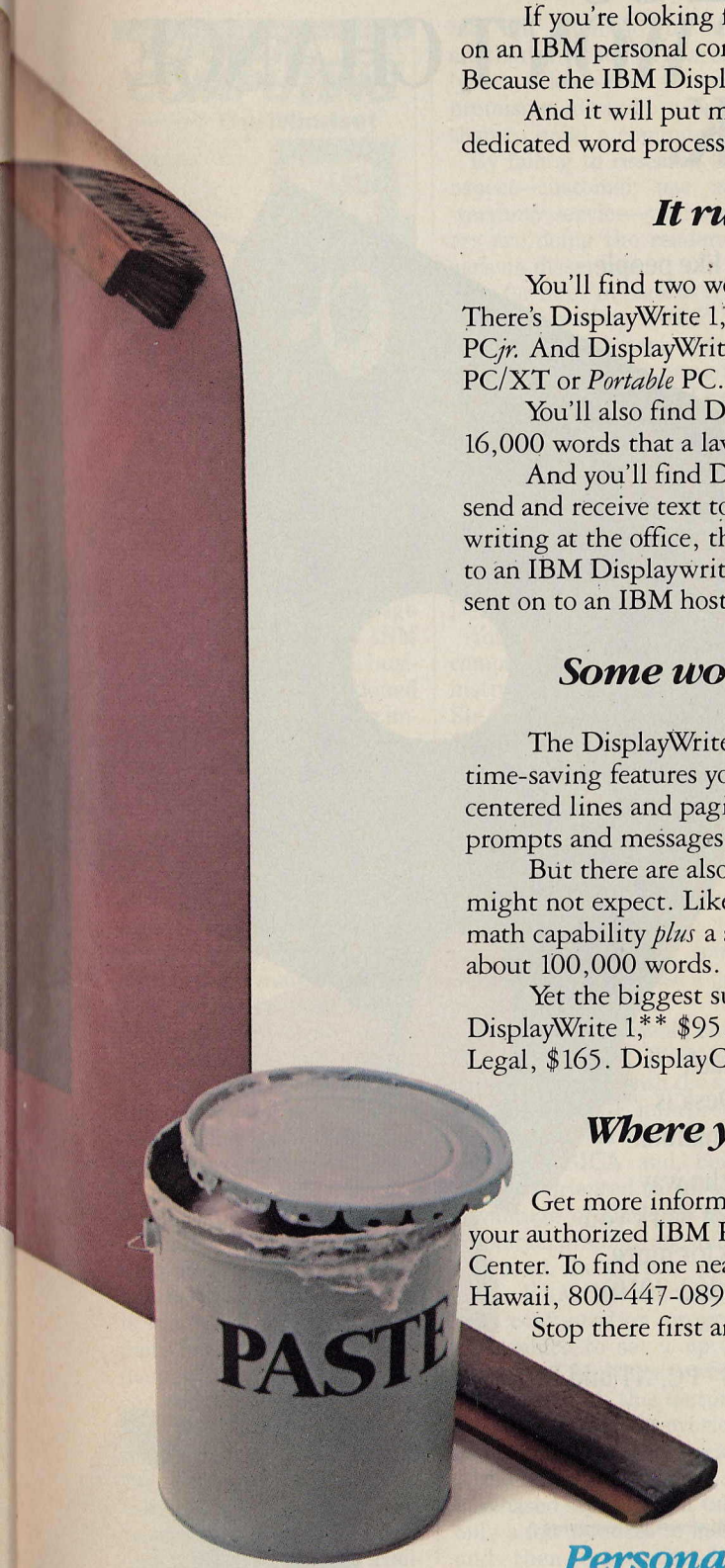
But there are also some features in DisplayWrite 2 you might not expect. Like easy column formatting, four-function math capability *plus* a spelling checker based on a dictionary of about 100,000 words.

Yet the biggest surprise of all may be the price.* DisplayWrite 1,** $95. DisplayWrite 2, $299. DisplayWrite Legal, $165. DisplayComm, $375.

## *Where you can find all four.*

Get more information about the IBM DisplayWrite Series at your authorized IBM Personal Computer dealer or IBM Product Center. To find one near you, call 800-447-4700. In Alaska or Hawaii, 800-447-0890.

Stop there first and get the last word.

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It's called Electric Desk™ from Alpha.® And it's the only software you can buy that actually lets you move instantly from one job to another—from a letter to a memo to a budget to a customer list, over to a stock report and back—all with a couple of keystrokes.

Try that with other software and you'll end up switching disks, reading and writing files, switching disks again, waiting, worrying, trying to remember different commands for different software packages. Not very natural.

But with Electric Desk, virtually all the computer power you need—including word processing, spreadsheet, data base and communications—can all be going at the very same time. All from a single program with one set of easy commands.

You can even split your screen into windows and work on two jobs at once. Or shoot information from one file to another in a flash. Not even the most expensive integrated packages work as quickly or as well. And what's best is Electric Desk is so easy to learn and use, many people never even look at the manual.

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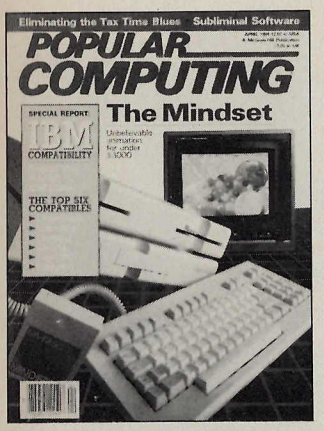


**Corona Disk Crashes**
Dear Editor:

I could barely wait to finish reading your April article about IBM PC clones ("The Top Six Compatibles," page 132). Having owned an IBM System 34 in a previous business, I was fully conditioned to accept every favorable impression about the clones when I decided to buy a 10-megabyte PC for my new operation. The compatible I chose was the new 10-megabyte Corona with 256K bytes of memory. There is no question about it—the Corona obviously offers more features and better value than the IBM and several other brands. Unfortunately, that's where the advantages end.

I took delivery of my machine on a Thursday and its disk crashed on Friday during the program installation. It was out of use for one week. After it was returned, it managed to continue running for 2½ full hours before another disk crash. This time it was at the factory for repairs for two weeks. Delving deeper into matters, I discovered that the dealer I had purchased it from had three machines with crashed disks the same week. The explanation for the slow repair service was that Corona had only one service technician available but planned to hire another one soon. Apparently, it's a lot easier to write promising ads and brochures than to build a computer.

By failing to research this aspect—customer use and warranty service—your writers are doing the readers a serious disservice.

As for me, I'm back to IBM with a souped-up IBM PC. I would rather have fewer horns and whistles, pay a little more, but know that I have something that has been tested and which can be repaired quickly.
*Alan Goldsmith*
*Santa Monica, CA*

**Sold on Corona**
Dear Editor:

Your recent review of IBM compatibles was both informative and timely ("The Top Six Compatibles" April, page 132). However, as an owner of a Corona PC-2 I must take some exception to James A. McCoy's review of the Corona computer. A "few" details that were left out about the system's standard configuration just might make the critical difference for someone about to purchase a personal computer.

First, readers should know that Microsoft's GWBASIC comes standard with the system. This BASIC interpreter is the functional equivalent of IBM's BASICA and, being graphics oriented, it can take advantage of Corona's high-resolution graphics capability.

Second, the Corona comes with a RAM disk and a rather nice configuration program with which to set it up (incidentally, Multimate works very well with this feature).

Third, one cannot overlook the 8087 coprocessor socket. Although the chip must be purchased separately, it takes only a few minutes to install and then reset the DIP switches accordingly, and you still haven't used any of the expansion slots.

Fourth, for those interested in such things, there is the small matter of the light pen connector, already built in and ready for use.

Combine all of this together with what Mr. McCoy wrote and then, and only then, can one begin to realize just what a "buy" the Corona really is.
*Ralph L. Sorrell*
*Burke, VA*

**Keeping Ads Separate**
Dear Editor:

Why don't you put reader service numbers on your reviewed products? It took me two days to write to all the companies that I was interested in. If I had been able to circle numbers on a reader service card, it would have taken two minutes.
*Donald F. Leslie*
*Cardiff, CA*

*We do not include reader service numbers with our product reviews because we believe that such a practice implies that our reviews are tied to the advertising in the magazine. We choose products for review that we believe will be of most interest to our readers and take great pains to find competent reviewers, who like the rest of our readers are interested in the application of the product to their lives. Even though an issue may contain ads about the products that are reviewed, there is absolutely no connection between them.*

*Reviews are commissioned months in advance of publication, and the final selection for publication is made each month without any idea of which firms will be advertising. If we give even one reader the impression that our reviews are tied to the expenditure of advertising dollars, we fail in our mission to provide the highest quality of objective reporting about microcomputer hardware and software products.*

*We are well aware of the fact that computing remains expensive and feel a responsibility to guide our readers to a careful purchase, one that will satisfy their computing needs. We do this by offering well-researched product information that remains objective and analytical. It may take you a few more days to get information from a company but, in our view, the separation of advertising and editorial content is a critical consideration.*

**Converting to Dvorak**
Dear Editor:

The Dvorak keyboard ("Ask Popular," April, page 14) is definitely a (small) step ahead. As you point out, with encoded, programmable, hopefully exchangeable computer keyboards the time for keyboard evolution is at hand. But software translation of QWERTY to the Dvorak keyboard isn't as practical as it sounds.

QWERTY has period and comma where Dvorak has Z and V. See how far you get translating Control-period to Control-Z. Also, when you convert ^H to ^D, ^J to ^H, ^I to ^R, you convert back space to ^D (forward space in Wordstar), line feed to back space and tab to ^R. Luckily, ^M (return) is still ^M. I bought Smartkey because it was advertised for this purpose. Luckily, instead, it's a valuable supplement to Wordstar when using a not-so-smart terminal.

I have been experimenting with keyboard design for a couple years. I doubt that Dvorak is the ultimate key format but lacking information on a better one, or on a

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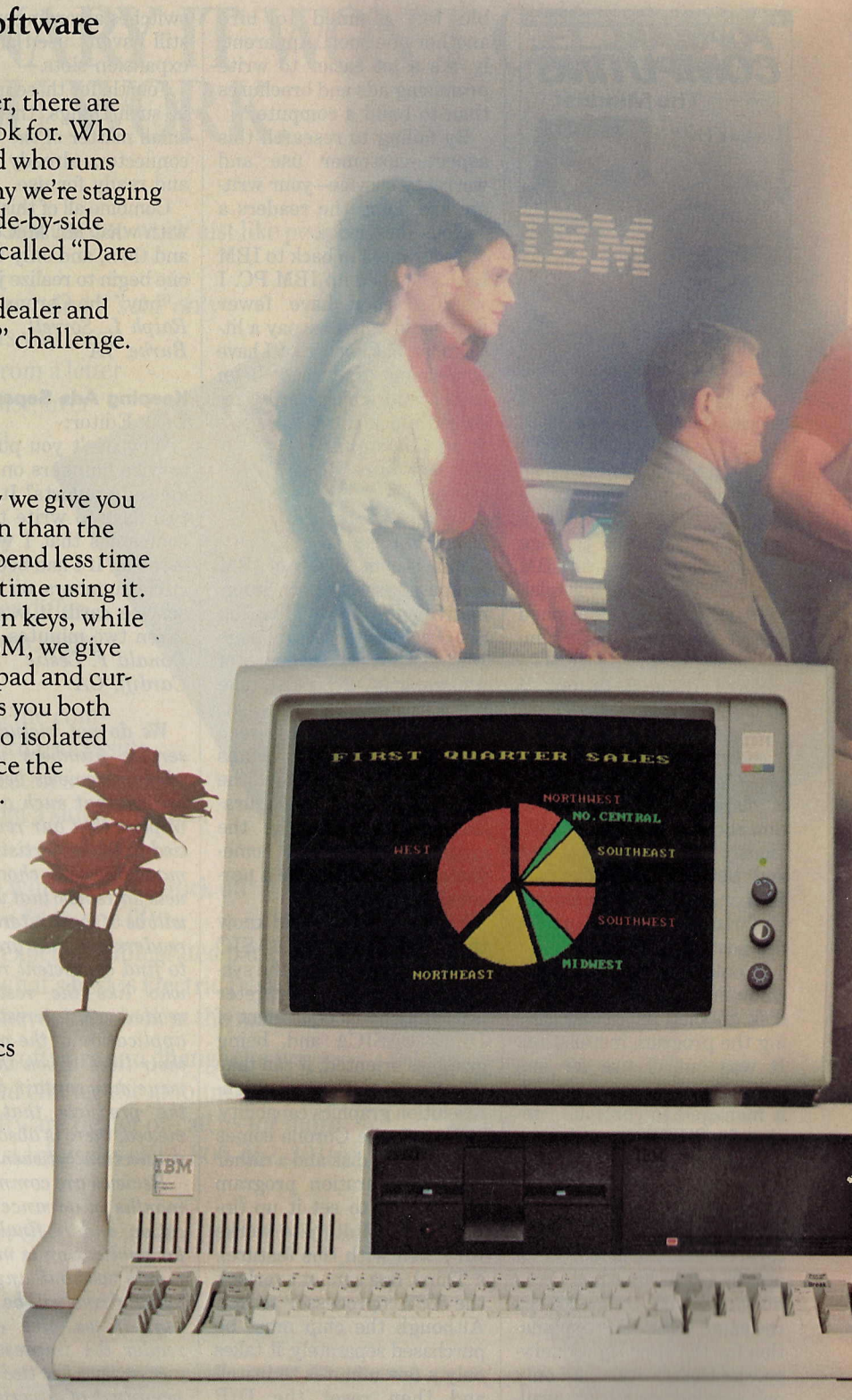


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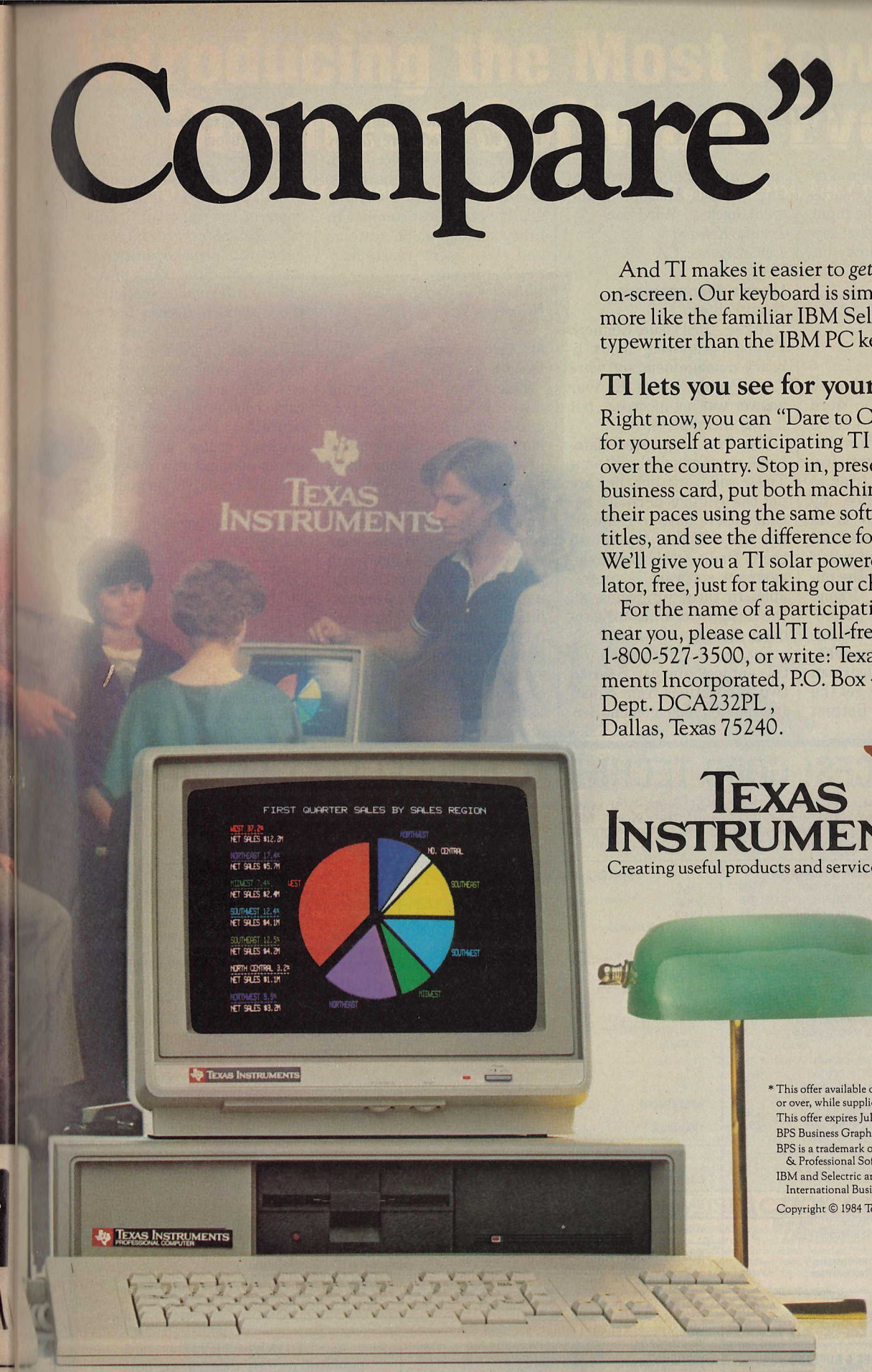


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## LETTERS

Dvorak encoder, I laboriously crosswire my keyboards and plug them into the input of my QWERTY terminal keyboard encoder (without disabling that keyboard).
*Dan Robinson*
*San Francisco, CA*

### Word Problems

Dear Editor:

I read your reviewer's evaluation of Microsoft's Word (May, page 163), and it left me laughing. I bought Word because of its advertising claims; but when we tried to use it in my law office, my legal assistant, who is in charge of drafting on our IBM PC, spent a week and a half trying to understand the unintelligible manual. Phone calls to Microsoft accomplished nothing. I wrote letters to the marketing manager with a copy to Chairman Bill Gates and did not get the courtesy of a reply. Bottom line: we junked the program and, with it, Microplan, and went back to Wordstar.
*Irving Kellogg*
*Los Angeles, CA*

### Library Management

Dear Editor:

In the April issue, Kenneth Umbach inquired about library management software ("Ask Popular," page 16). Your answer was not incorrect, but it was incomplete.

You first suggested database management systems. These will work, but they are not the systems of choice because users have to reinvent the wheel if they try to use them. Dedicated library management software is preferable. In these programs, all the design work has already been done for the user.

For good information on this subject, you can refer to two publications from Nolan Information Management Services of Torrance, California. Their *Micro Software Report* is an index to software with specific library applications. *Micro Software Evaluations* analyzes the most common library management systems and gives users' reactions.
*Pat Berglund*
*Wilson Library Bulletin*
*Bronx, NY*

### No Errors Found

Dear Editor:

Thank you for reviewing my book *Apple II Basic Programs in Minutes* in your May issue (page 185). Since all programs in the book have been thoroughly tested, and since the actual computer listings were typeset from photocopies of the programs, your reviewer's report of four small program errors was disturbing. I rechecked the program lines in question. There are no errors and in fact the suggested semicolons lead to a syntax error.
*Stan Trost*
*Walnut Creek, CA*

### Best Way to Learn

Dear Editor:

Dan Watt's article "Neighborhood Computer Centers" (May, page 91) illustrates some of the gains and pains of informal education management. Formal education is years behind the needs of the public. Informal education is the most cost-effective way to build the computer market; it is also the most effective way to teach information technology. When the guru-supplicant relationship of formal education is removed and learning takes place in a group-dynamic environment, individual motivation goes off the scale.
*Howard Scoggins*
*Austin, TX*

*Popular Computing* welcomes your feedback regarding articles that appear in this magazine as well as your comments about the personal computing field in general. Write to Letters, *Popular Computing,* POB 397, Hancock, NH 03449. (Due to the number of letters received, we cannot respond individually.)


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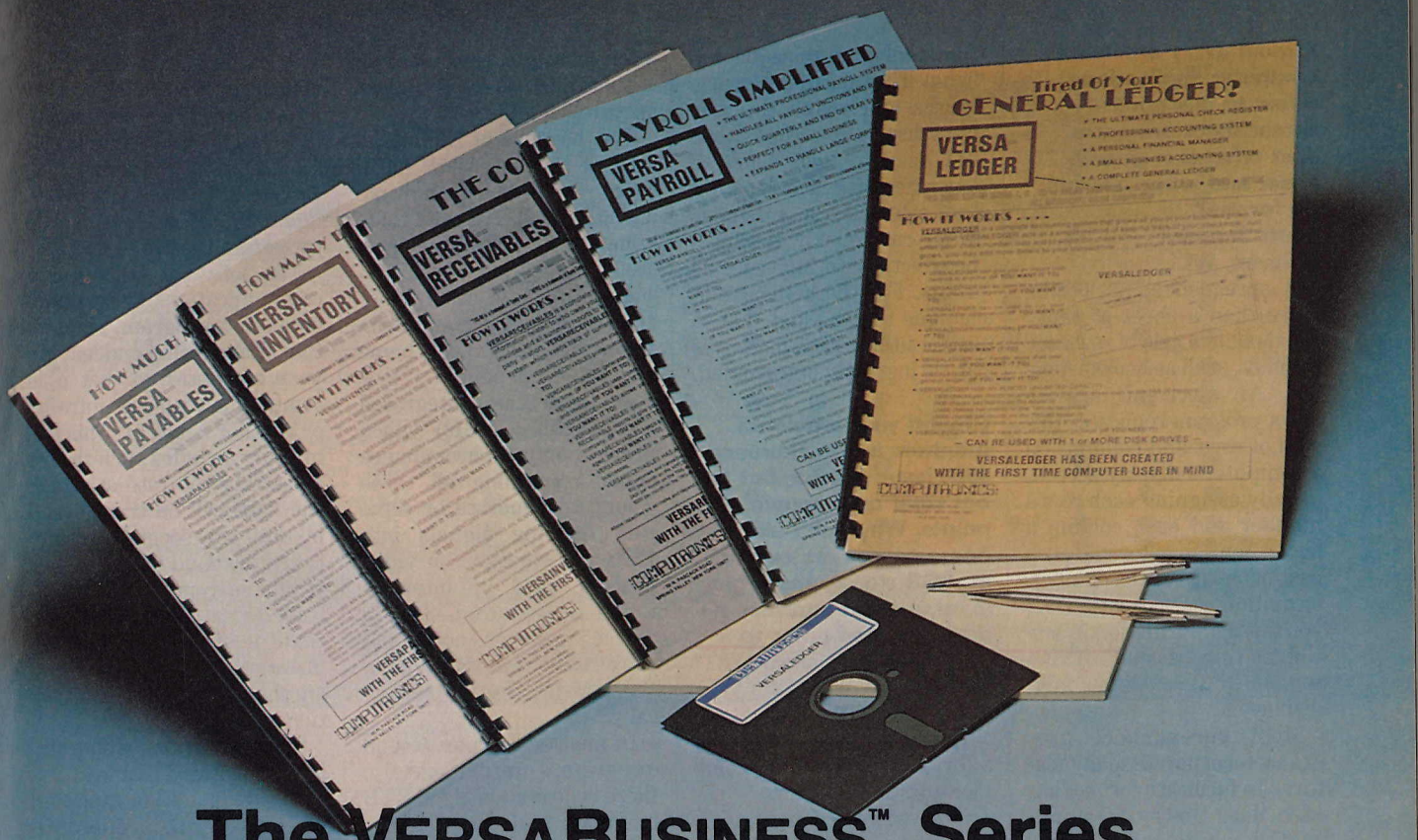


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**Almost every article on computer applications refers to electronic spreadsheet programs. Just what is a spreadsheet and what can one do for me?**
**Scott Schmidt**
**Delavan, WI**

A spreadsheet is nothing more than a sheet of paper ruled out in a grid of rows and columns, such as bookkeepers use. An electronic spreadsheet program replicates this grid of rows and columns on a computer's display screen, usually assigning each row a number and each column a letter. You can enter into each box, or "cell," a title, number, or mathematical relation. As you enter information in one cell, all related cells are subsequently recalculated and displayed.

Most spreadsheet programs incorporate many features to facilitate formatting and data entry. Column widths can be varied, numbers can be centered, and data can be right or left justified. All numbers can be instantly changed to dollars, complete with dollar sign and decimal rounding to two places. Horizontal or vertical windows can be created so that two groups of data can be viewed and compared.

Small businesses recognize spreadsheet programs as a vital asset. Inventory control, budgeting, and payroll are just a few of the applications where spreadsheets might help improve accounting efficiency.

Personal uses for spreadsheets include home budget and checkbook management, team statistics and averages, income tax calculations, and record keeping.

One of the most powerful uses of a spreadsheet program is rapid assessment of the effect of possible changes. Commonly known as playing "what-if," you can enter new figures and watch the program display, in seconds, data that used to take hours to generate with a calculator. For example, a business owner can quickly establish the effect of cost increases on profits. For the homeowner, changes to a budget due to tax or utility rate increases can be instantly determined.

**I found your article on monitors in the February 1984 issue helpful, but I'm not clear on a couple of points. Why don't all home computers output an RGB signal, and what is required to interface a particular computer to a particular RGB monitor?**
**W. Ju**
**New York, NY**

To answer your questions, a brief discussion of color monitors is in order.

Color monitors and television sets use a cathode ray tube (CRT) that contains three color electron guns: red, green, and blue (hence the designation RGB). These guns, arranged either in a triangle pattern or in line, direct their beams of electrons toward the face of the tube and mix to form the various colors and intensity levels of the displayed image. (Note that these primary "electronic colors" are different from the "palette" primary colors red, yellow, and blue.)

In TV sets and low-cost color monitors, one input signal contains information for the proper proportion and synchronization of the three colors. This composite video signal is separated to drive each of the three color guns. The more expensive RGB monitors use separate signals for color and synchronizing to allow individual control of each color gun, thus creating a sharper, more detailed picture.

But because of the added cost of the necessary hardware to produce multiple video signals, most home computers offer only composite color. Also, an RGB monitor easily costs more than the typical home computer. In fact, most home computers depend on low-cost large-scale integrated circuit chips (LSIs) which provide only a chrominance signal containing all three colors; to generate or separate existing signals into RGB information, a video decoder card or interface would be required. Such a device, however, could not convert the computer's composite video signal economically.

In answer to your second question, unfortunately, there is no standard for RGB monitors, and compatibility problems do exist. The synchronizing signal can be combined with one of the color signals or as a fourth input, and video bandwidths and resolution (the number of dots or pixels on a horizontal line) vary widely. If your computer supports an RGB monitor, ask you computer dealer for help to be sure that the monitor and computer are compatible.

**I plan to purchase a modem for my Apple IIe and want to know what is required to communicate directly with a mainframe computer such as an IBM or DEC. Also, can my computer communicate directly with another Apple II computer or must I use a communications network such as The Source or Compuserve?**
**Richard Bloch**
**Homewood, IL**

A modem is a device for connecting your computer to a telephone line to communicate with other computers. Such a connection allows your computer to act as an intelligent terminal, given the proper software.

The software, known as a communications or terminal emulation program, formats the data entering and leaving your computer so that it is compatible with a mainframe or another Apple II. This formatting includes such things as setting the rate at which the data will be transferred in bits per second (usually called the baud rate), number of bits surrounding the data (called start and stop bits) so that the other computer can distinguish one letter from another, and an error-detection scheme.

Such programs generally include features that load and save data on disk or tape, and when used with an appropriate auto-dial modem, some provide automatic telephone dialing. Some can also automatically log on to a network or bulletin board, answer the phone, and control a remote computer.

Connecting a modem to your Apple IIe requires only an accessory card that provides an RS-232 serial port. A cable from this port to the modem completes the interface, and the modem output is connected into the phone line by a modular telephone connector or acoustic coupler. The appropriate software is then loaded, and communications can begin.

If the two Apple computers are in close proximity, a

Ask Popular is a monthly column conducted by contributing editors Harvey Weiner and Steve Ciarcia to answer general questions about small computers. Send your questions to Ask Popular, POB 397, Hancock, NH 03449.

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| 18 cps min. speed | | ● | | | ● | | ● | ● | ● | | | ● |
| Buffer memory | ● | ● | | | ● | | | ● | ● | ● | | ● |
| Proportional spacing | ● | ● | | ● | ● | | ● | ● | ● | | | ● |
| Prints graphics | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● |
| 11" min. print line | ● | ● | | ● | ● | | ● | ● | ● | | ● | ● |
| 100-character wheel | | | | | | | | | | | | ● |
| Orig. +3 copies or more | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
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| Linear stepper carr. motor | | | | | | ● | ● | | | ● | | ● |
| Buffer expandable to 8K | ● | | | | ● | | | | | | ● | ● |
| Weighs under 35 lbs. | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● |

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## ASK POPULAR

modem is unnecessary. Connecting a cable between the RS-232 serial ports will permit communication without tying up the phone line. The instruction manual for the serial card will explain the necessary connections.

For more information, see our July issue, which featured a Special Report on telecomputing, including buyer's guides to modems and communications software.

**Is it possible to damage a peripheral card just by handling it?**
**Charles Prestia**
**Chelmsford, MA**

Yes. The static electricity you generate by walking on a rug is often several thousand volts, enough to cause permanent damage to many electronic components if you touch them. Some integrated circuits, especially the MOS (metal oxide semiconductor) and CMOS (complementary metal oxide semiconductor) types are particularly vulnerable but are less susceptible when installed on a circuit board because the board has a positive ground.

To dispel a potential static charge, a good practice is to touch a grounded surface before handling any static-sensitive component, whether loose or mounted on a printed-circuit board. When not in use, peripheral cards should be stored in antistatic plastic bags and integrated circuits in conductive foam to prevent accidental damage.

**I have a Commodore 64 computer and want to display a formatted output, but in my numerical outputs, zeros trailing the decimal point are omitted. For example, if I have an input of $10.00, only the $10. is displayed. I know some versions of BASIC use a notation for formatting the output. Is there such a solution for my Commodore 64?**
**Rodney Kalich**
**Floresville, TX**

The BASIC statement that allows numerical formatting is the PRINT USING statement, but the Commodore 64 does not support it.

There is, however, an easy way to incorporate the PRINT USING function into your Commodore 64 BASIC instruction set using a plug-in cartridge. ExBasic Level II from Data Dynamics Technology (POB 1217, Cerritos, CA 90701; (213) 926-9544) adds over 80 new commands, statements, and functions to your computer's built-in BASIC. The extended BASIC that it provides is similar to the Radio Shack Level II BASIC and will allow you to run many TRS-80 BASIC programs.

Other added commands include IF...THEN...ELSE, INPUTFORM and INPUTLINE (allows formatting of input statements), PRINT@, and commands for an 80-column screen. Commands for faster LOAD, SAVE, and VERIFY of tape operations and many graphics commands are also included. The price of the cartridge and 60-page manual is $98.

**Is there an IBM PC program designed to store genealogical data and produce charts or lists (by generations) showing ancestors and descendants of any included individual?**
**Polly Hedge**
**Bremen, ME**

Family Roots, a genealogy research program from Quinsept Inc. (POB 216, Lexington, MA 02173; (617) 862-0404) can generate two types of pedigree charts as well as a chart of descendants. Lists and tables can also be produced from stored data. A versatile edit mode simplifies


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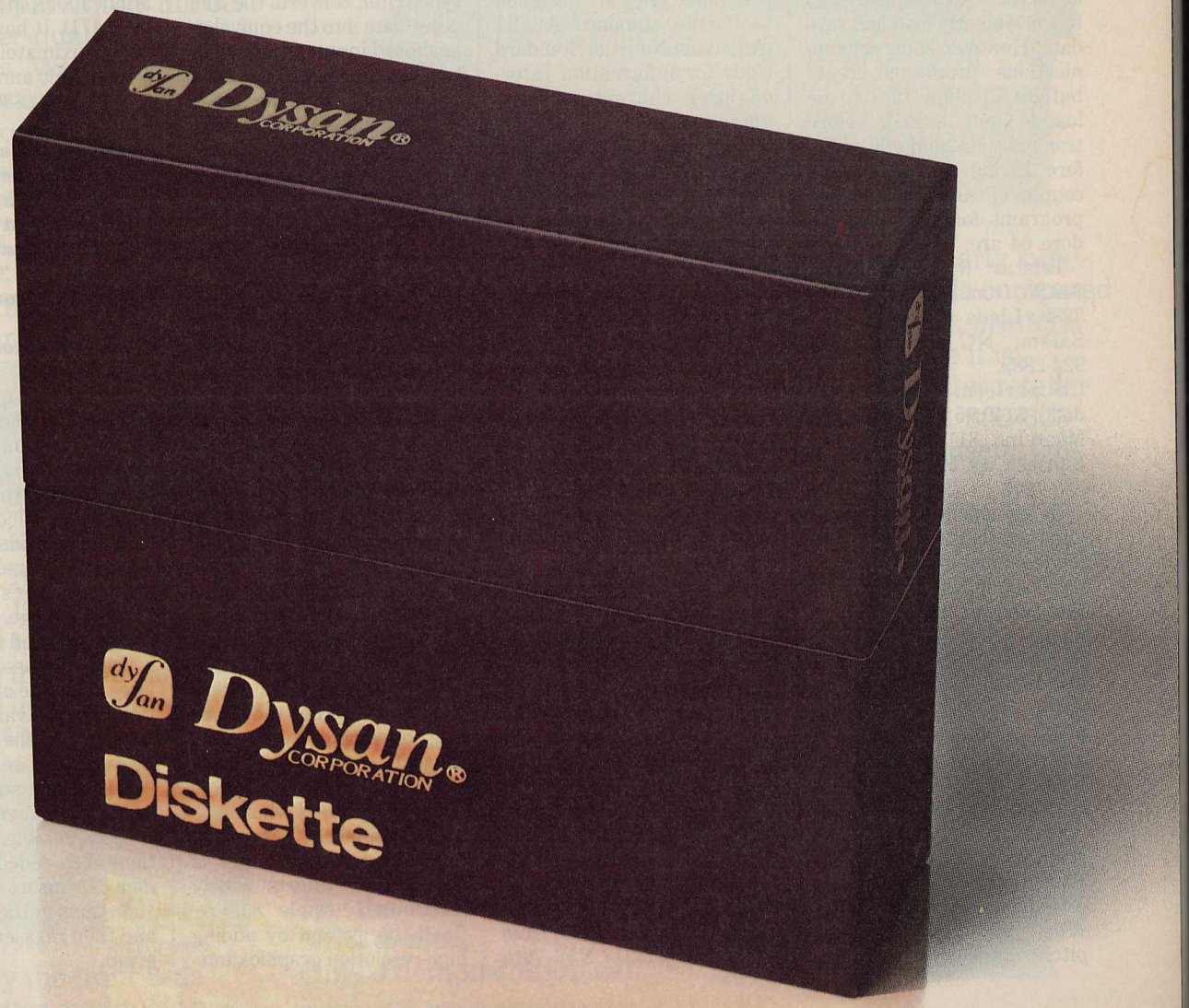

the entry of basic family data, and a text mode establishes a card file system for miscellaneous notes. A search mode and utilities to generate address lists and print blank charts are also available. The price is $185.

**My friend and I would like to exchange programs and data with our Commodore 64 computers and VICMODEMS and save them on cassette tape. Could you tell us how this can be done?**
**Jon White**
**Visalia, CA**

The terminal program that comes with your VICMODEM is suitable for communication with bulletin boards and databases, but it lacks the features necessary to conveniently load and save data. However, some communications programs create buffers to allow files to be loaded and edited before transmission, and edited before saving on cassette. A couple of suitable terminal programs for your Commodore 64 are:

Telstar 64 (cartridge), $49.95, from Eastern House, 3239 Linda Dr., Winston-Salem, NC 27106; (919) 924-2889.

Superterm (cassette or disk), $149.95, from Midwest Micro Inc., 311 West 72nd St., Kansas City, MO 64114; (816) 333-7200.

To establish communications between computers, one modem must be in the "originate" mode, and the other in the "answer mode." These modes select pairs of tones for two-way data transfer. It does not matter which computer is in the originate mode, and both computers can send and receive data. Both modems should be in the "full-duplex" mode.

Finally, you load the program to be transmitted into the computer's memory and establish telephone contact. When you hear the high-pitched tone of the receiving modem, you can begin transmitting the file. Meanwhile, the receiving computer's communication program must be instructed to receive the file.

**I own an IBM PC with 64K bytes of random access memory, and I have two questions: Can I use a spelling program for my own text files even though I don't use a word-processing program? Can I run programs that use color and graphics on my monochrome display if I have the color-graphics adapter?**
**Vincent Mongiando II**
**Bulan, KY**

First, most dictionary programs operate independently of any word-processing programs. They are designed to handle standard ASCII (American National Standard Code for Information Interchange) characters, and unique text files, such as those created with the Easy Writer II word-processing program, must be converted. Conversion programs are often supplied with the dictionary programs. When run, the dictionary program asks for the name of the text file to be reviewed. Most text files can then be processed.

In answer to your second question, the monochrome display should not be plugged into the color-graphics board. However, the video output from the color-graphics board is compatible with standard television frequencies and allows a variety of monitors to be used.

You can display graphics on the monochrome display only by using an accessory board designed specifically for that purpose. Here are a few boards and their manufacturers:

Hercules Graphics Card, $499, from Hercules Computer Technology (2550 Ninth St., Suite 210, Berkeley, CA 94710; (415) 540-6000).

The Chairman, $595, from Mylex Corp. (5217 N.W. 79th Ave., Miami, FL 33166; (800) 446-9539; in Florida (800) 336-9539.

Graphics Master, $695, from Tecmar (6225 Cochran Rd., Cleveland, OH 44139; (216) 349-0600).

Graphics Edge, $499, from Everex Systems (891 Maude Ave., Mountain View, CA 94043; (800) 821-0806; in California (800) 821-0807.

**I own an Olivetti Praxis 35 electronic typewriter. Can I use it as a printer for my computer?**
**George A. Borle Jr.**
**St. Albert, Alberta**
**Canada**

The Olivetti Praxis 35 was designed as a portable electronic typewriter but can easily be adapted for use as a letter-quality printer for your computer. A special interface, mounted inside the typewriter, converts the computer data into the equivalent keyboard input. One such interface is available from Bytewriter (125 Northview Rd., Ithaca, NY 14850; (607) 272-1132) for $165. It connects to the parallel port on your computer.

**Does the operational concept of Apple's Lisa and Macintosh computers (with the use of icons, windows, and a mouse) have any relationship to the Xerox Palo Alto Research Center (PARC) system called Smalltalk?**
**Thomas Norton**
**Sparkill, NY**

Yes. The Smalltalk system was designed at Xerox PARC in the 1970s and featured a bit-mapped video display, a mouse to simplify user entry, and an easy-to-understand programming environment.

The designers at Apple were impressed by the Smalltalk operating system because its concept was simple to master. In fact, several of the programmers who developed Smalltalk at Xerox were lured to Apple in hopes of seeing their efforts widely distributed. Apple has refined the system by adding high-resolution graphics, integrated software, and a high degree of consistency between programs. While icon (picture) and mouse user-interface technology was first used in the $15,000 Xerox Star computer, Apple pioneered the concept for use in personal computers.

**In one of your Educational Computing columns, you mentioned *Training*, a magazine for professional trainers. I have been unable to locate it anywhere. Can you help me?**
**Helen Paleos**
**Ambridge, PA**

*Training*, The Magazine of Human Resources Development, was formerly known as *Training in Business and Industry*. It is a monthly published by Lakewood Publications, Inc. (731 Hennepin Ave., Minneapolis, MN 55403; (612) 333-0471). It has a circulation of approximately 40,000, and the current annual subscription price is $36.

**I want to access some of the CP/M public-domain software libraries, but I've been told that I must obtain a communications program and "assemble" it. What is meant by "assemble"?**
**Harold Houston**
**Denver, CO**

Sometimes a program is supplied in the form of assembly-language "source code," which is a list of abbreviated microprocessor instructions called mnemonics. This source code must be converted, or "assembled," into the computer's native machine language. To do this, a program called an assembler is used. The assembler translates each line of source code into the equivalent machine code, placing the user-supplied addresses as required.

A program supplied in assembly-language source code is very flexible. If modifications are needed, a programmer can insert or delete instructions in the source code and then reassemble the program. □

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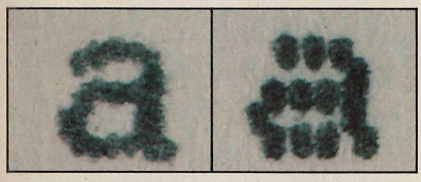

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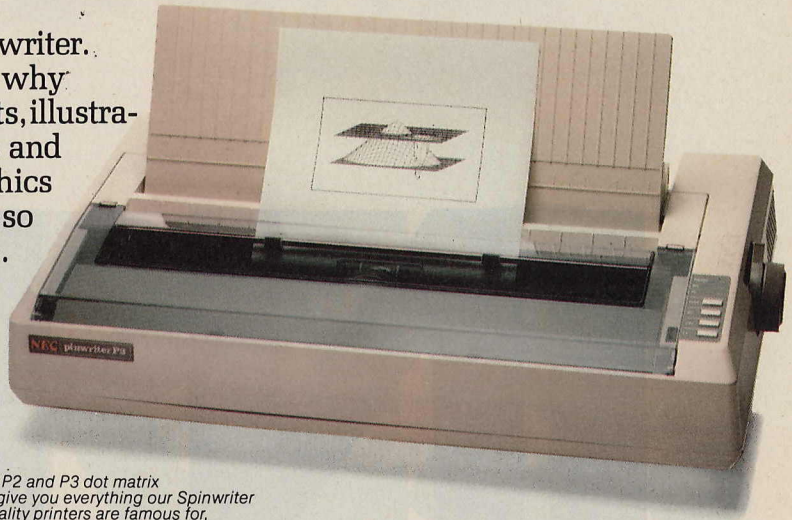


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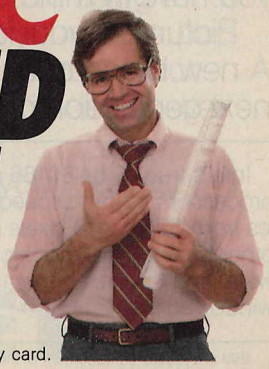

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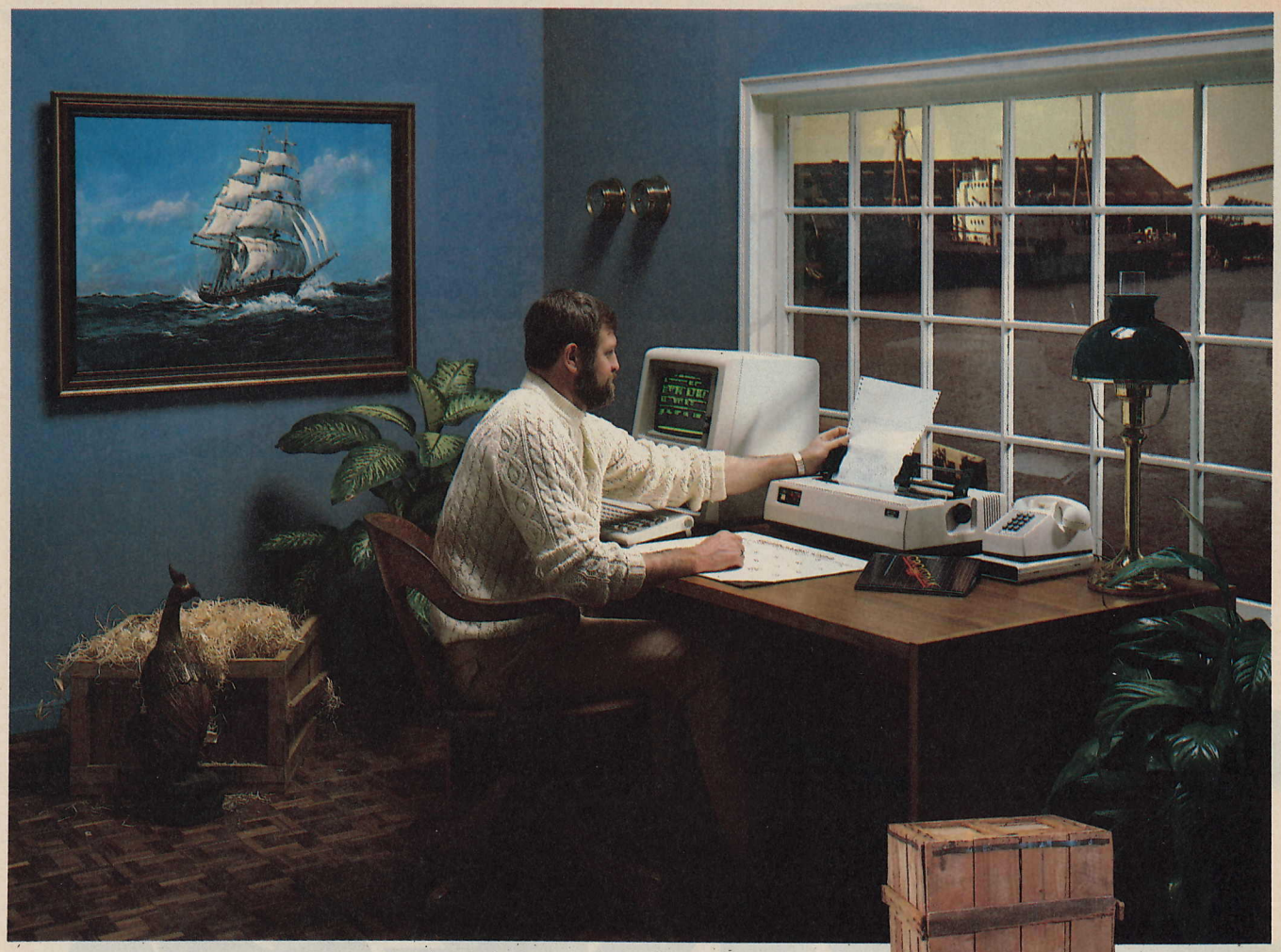

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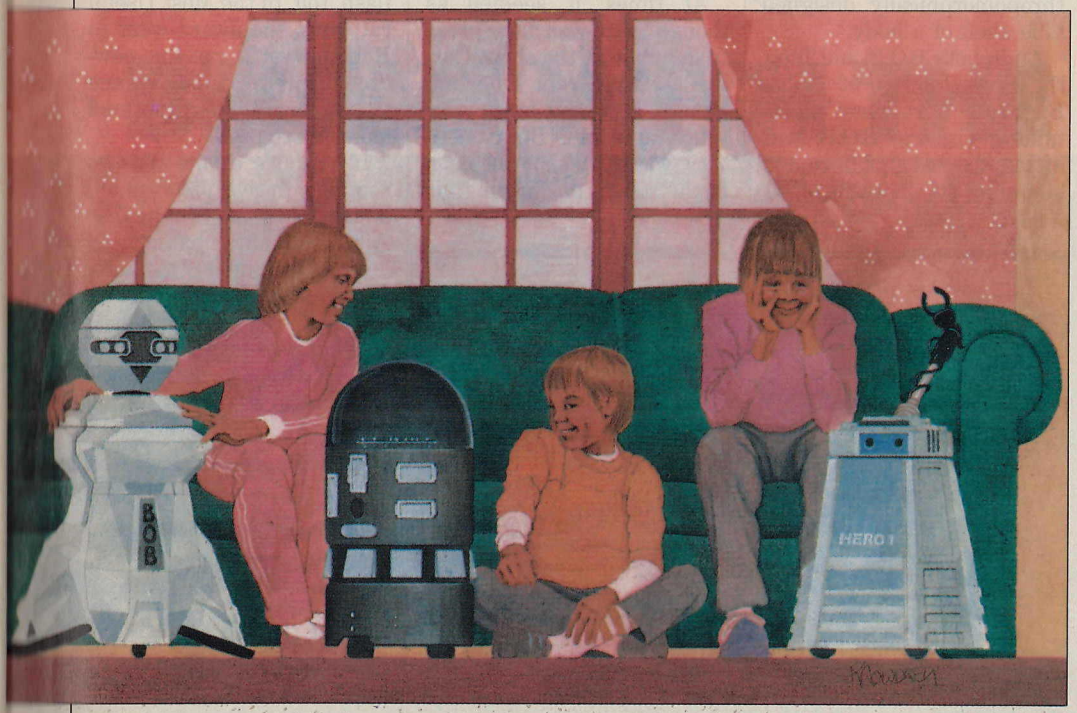
# Report from the First Home Robot Show

Is there a robot in your future? Judging from the first International Personal Robot Congress and Exposition, which met in mid-April in Albuquerque, New Mexico, the answer is a qualified yes. Robots for home and personal use are still in the embryonic stages of development, much as microcomputers were a decade ago, but they're coming. Looking back, it was also in Albuquerque that the first micro—the MITS Altair—was introduced to the public nearly 10 years ago.

Whether home robotics will achieve the same exalted heights as the microcomputer industry, of course, is anybody's guess. Currently, there are three major entrants in the field: Heath Co., RB Robot, and Nolan Bushnell's Androbot Co. A fourth, Hubotics Corp. (which was notable for its absence from the show), is making some important contributions. At the moment, the lion's share of the market belongs to Heath's HERO-1 (see page 166 of our December 1983 issue), which shipped between 7000 and 8000 units last year for sales of $15 million, according to Jean-Michel Gabet, of Cosma International, a consulting firm in Redwood City, California, that tracks the industry. RB Robot sold an estimated 400 units for sales of about $1 million, with a projected $3 million in sales this year, says Gabet. Heath is also expected to triple its sales this year.




A diverse group of entrepreneurs, hobbyists, robot enthusiasts, manufacturers, and press far outnumbered the 25 official exhibitors. For years, science fiction has fueled the public's interest in robots, and having a robot as a companion and cheap laborer is a dream hard to kill. And as Albuquerque proved, the new frontier for hardware hackers is robots.

Isaac Asimov, the science-fiction writer and author of over 300 books, delivered the conference's keynote speech via satellite from New York. As inventor of the Three Laws of Robotics, which were part of a science fiction story he wrote at age 19 back in 1941, Asimov said, "Robots are simply mobile computers."

Mobile indeed. As Asimov was speaking, robots of another technological order had returned from repairing Solar Max, the malfunctioning satellite, in orbit 300 miles above the Earth.

Industrial robots, as opposed to those designed primarily for the home, have been around since the early 1960s. Typically, robots have found a place on assembly lines, lifting heavy objects and welding steel. These robots are stationary, not mobile. In the early 1970s, companies developed robots that could actually move around in a factory, following wires placed in the floor. Battery-powered, they could carry parts from one location to another. The Swedish auto manufacturer Volvo has used those kinds of robots in its assembly plants for several years. But it's only been within the last year or two that these technologies—accelerated by the microprocessor that acts as the robot's brain—have merged in a fashion that could be viable for the home market.

At Albuquerque, the robots came in all shapes and sizes. Attracting the most attention was RB5X, RB Robot Corp.'s 23-inch-tall, 24-pound entry. This $2300 robot looks like R2D2, is programmed in BASIC to speak English, and uses a Polaroid Rangefinder sonar system to navigate around your house.

Illustration by Richard Cowdrey

His legs consist of two independently driven wheels and he comes with an optional robotic arm that has five-way movement capability and is able to pick up, carry, and release objects that weigh up to 16 ounces. You can plug RB5X into your computer with a standard RS-232 interface and program his movements to your heart's content.

RB5X's chief rival at the show was Heath's HERO-1. He's controlled by an onboard 8-bit 6808 microprocessor and can be programmed by entering instructions through a hexadecimal keyboard mounted on top of his head. HERO-1 will travel over a prescribed course and repeat specific functions on a preset schedule. With an optional arm and gripper mechanism, he can be programmed to pick up small objects. Also, with an optional speech synthesizer, you can get HERO-1 to simulate human speech in a system that generates up to 64 phonemes (speech sounds). In kit form, HERO-1 retails for about $1200; fully assembled, with arm and voice, the robot costs $2200.

On the second day of the show, HERO-1 and RB5X got into a friendly jousting match. Elsewhere on the floor, a robot named AROK, standing 6 feet tall and weighing 275 pounds, was shaking hands with people and inviting women and kids to ride on his platform. In exchange, AROK, who looks like a cross between the Tin Man from *The Wizard of Oz* and C3PO, demanded a kiss. AROK's builder, hobbyist Ben Skora, from Palos Hills, Illinois, said that he spent almost three years teaching the robot to vacuum his floors, pour drinks, and take out the garbage.

Marvin Mark I, from Iowa Precision Robotics Ltd., combined brains (an on-board 16-bit 68000 microprocessor) and brawn (two arms capable of lifting at least 5 pounds with each gripper) in an anthropomorphically designed blue shell of a body.

Androbot's B.O.B. and Topo, the brainchildren of Nolan Bushnell, were busy entertaining visitors; B.O.B. was lifting six-packs of beer and bounding off the walls of his prescribed pen. Neither B.O.B. nor Topo would win a beauty contest—their bodies are far from cute and cuddly. According to Bushnell, "Americans want robots as pets and companions. A robot doesn't have to do anything but be charming."

But Joe Engleberger, the father of industrial robots, disagreed, saying, "Dammit, a robot has to do something."

The major issue debated was that of utility. Robots can attract crowds almost instantaneously and they are good pets for children. But when will they be able to earn their keep by performing routine chores such as washing windows or vacuuming floors? Everybody was curious about that, including representatives from a well-known vacuum cleaner company who were canvassing the show.

At times, it seemed as though there was more press than public at the show. Correspondents from England, France, Italy, and Japan were there, and an NBC camera crew was busy shooting each of the robots performing his bag of tricks, including the show stealer, a plastic toy robot named Maxx Steele. Maxx stands 2 feet high, walks and talks (by remote control), and plays games; he comes from Ideal, the CBS toy manufacturer, and is expected to retail for $300 to $400 this Christmas.

At the moment, you can buy very little software for any of these home robots. The question, again, is what useful tasks can home robots truly perform?

Some of the answers may lie with those developers who received Golden Droid awards. In the category of Most Entertaining Robot... and the winner is... Henry, a robot who stands 40 inches high, turns in his own space, with two arms that hold glasses of water. He makes all kinds of sounds and his lights flash, too. In the Most Useful category, the award went to Robomower, a gasoline-powered omnidirectional machine that can be programmed along a set path.

If today's home robots sound primitive, just remember that 10 years ago the first Altair computer came with 256 bits (yes, bits) of memory. It did not have a keyboard or a video display. The only way to input data was by manipulating switches, entering one bit at a time. □

# Videotex '84: A Technology Moving Toward a Market

**PC/Videotex turns the PCjr into a videotex terminal.**

Videotex has been tagged as a technology in search of a market, but judging from Videotex '84, a trade show and conference held in Chicago recently, the industry has clearly moved beyond its pioneer days. With 85 exhibitors and over 7000 attendees in the first two days, the show generated plenty of excitement and a sense of progress.

Videotex, in which text and graphics are combined to offer on-line information, is now well defined as a technology. The American National Standards Institute has established a specific version of NAPLPS (the North American Presentation-Level Protocol Syntax developed by Bell Labs and supported by AT&T) as the standard for graphics transmission via telephone lines, giving makers of hardware and software greater certainty about where the industry is headed.

But while the wheels are beginning to roll, the exact directions the videotex industry will take are still being mapped. One uncertainty is exactly what the divestiture of AT&T will mean in terms of increased competition and diversification of industries such as telephone services, data communications, television and radio, and computer technology.

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house business applications of videotex were the biggest news at the show. Digital Equipment Corp. unveiled VAX VTS, a videotex-based information system designed to run on its VAX minicomputers. VAX VTS will mesh with existing DEC systems to provide inexpensive, fully distributed communications of text and graphics. DEC also showed two software systems for its Professional 350 desktop computer. PRO/Videotex gives a single machine the capability of housing a stand-alone videotex database, thus eliminating the connection costs usually associated with videotex. PRO/NAPLPS turns a 350 (with optional high-resolution color monitor) into a videotex terminal for accessing on-line graphics-based information services.

AT&T announced several new videotex products, including the Videotex Information System, a complete turnkey system aimed at businesses that want to experiment with and develop in-house videotex applications. Also introduced was the AT&T Frame Creation System Series 700, which will convert a photo or drawing into a videotex screen in 15 seconds.

Never to be left behind, IBM strengthened videotex's appeal to the business market with its showing of SVS/1, a recently introduced system based on the company's Series/1 computers. SVS/1 enables an organization to establish a private videotex database for communication of text and graphics using the Prestel protocol or the company's own streamlined implementation of NAPLPS (a standard-to-be?).

Another clear signal that the business videotex market is the place to be is Compuserve's Executive Information Service, an on-line information service announced last October and given big billing at Videotex '84. Available either as an ASCII-based text display (like the standard Compuserve service) or as a NAPLPS videotex display offering graphics capabilities, the Executive Information Service adds to standard Compuserve offerings such business-oriented features as a wide range of current and historical stock market data, Standard and Poor's financial information, the Institutional Broker's Estimate System, demographic data, money market services, and Infoplex, an electronic mail service that also provides a gateway to the U.S. Postal Service's E-COM for hard-copy delivery.

One of the most promising home services to make its debut at Videotex '84 was Keyfax Interactive, a videotex service soon to be available in the greater Chicago area. Developed by Keycom Electronic Publishing (Schaumburg, Illinois), Keyfax will offer Chicagoans access to information ranging from news, weather, financial reports, and stock quotes to entertainment listings, gardening tips, and restaurant guides. Additionally, the interactive capabilities of videotex will enable Keyfax subscribers to transact business with banks, purchase theater tickets and retail items from on-line catalogs, make airline and hotel reservations, send electronic mail, and even play adventure games.

Keyfax was slated to be fully implemented by early summer. Subscribers will pay a one-time start-up fee of $25 and monthly charges of approximately $10 for 5 hours of access or $25 for 15 hours. Of special interest to home computer owners is the fact that a subscriber may use either the dedicated videotex terminal offered by Keyfax or a


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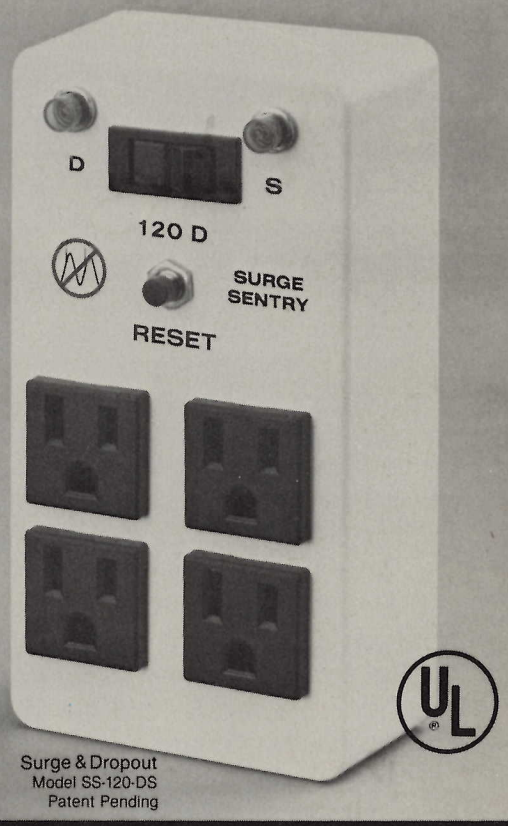


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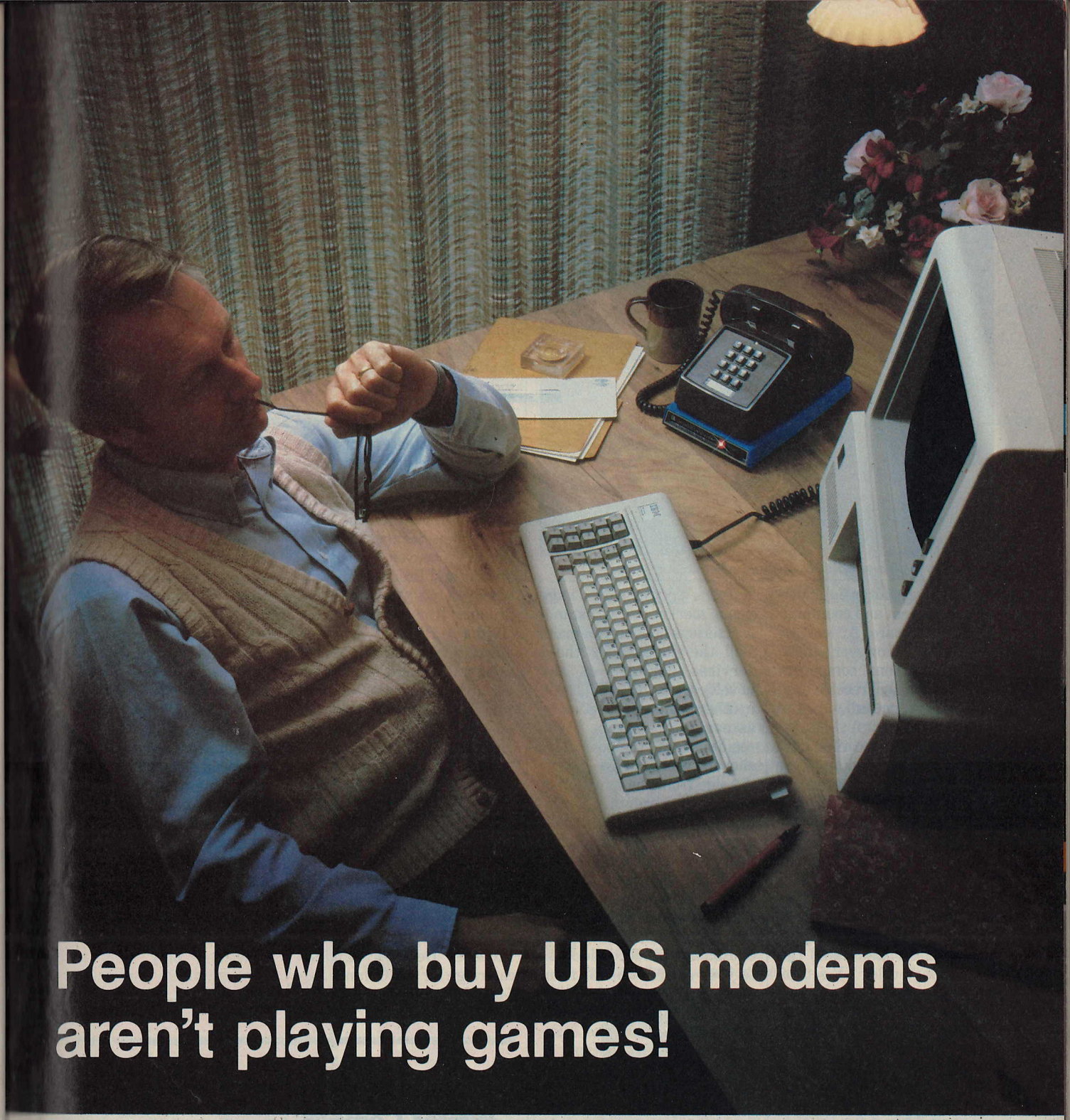

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**Keyfax will be available to Chicagoans this summer.**

personal computer equipped with a modem and communications software. At least at the outset, however, those who use personal computers as terminals will receive only ASCII text, not full videotex graphics.

A similar service offered by Times Mirror Videotex Services underwent a successful trial in 1982 and should become commercially available in a portion of Orange County, California, this summer. Called Gateway, the service will offer on-line information and transaction services through an AT&T Sceptre videotex terminal and the subscriber's color TV set for $30 per month.

Viewtron, a service of Knight-Ridder Newspapers' Viewdata Corporation of America, also made a big showing at Videotex '84. Offered in south Florida, Viewtron is the first fully commercial videotex service in the United States and has found, as Keyfax and Gateway hope to, substantial support from on-line advertisers. Subscribers have access to a wide range of information and transactional services, again using the Sceptre terminal.

Despite Viewtron's apparent success, representatives at the show would not reveal the number of subscribers. Optimism for a huge home market notwithstanding, serious questions remain: Will the demand for these services diminish as the novelty wears off? Will those in other parts of the nation be as eager to sign up as the residents of the carefully chosen test areas?

Aside from the question of consumer acceptance, the home videotex industry is embroiled in a divisive split over the use of dedicated videotex decoder/terminals versus personal computers with appropriate software. Although the battle for which equipment will feed videotex to your color TV is far from over, most experts feel that the personal computer will gradually become the standard means of reception.

Indeed, even Electrohome, the Kitchener, Ontario, manufacturer of widely used dedicated videotex decoders, presaged this eventuality with the introduction of its EGT100 NAPLPS decoder, which is really very close to being a personal computer. The decoder incorporates 512K bytes of nonvolatile memory and 16K bytes (expandable to 32K) of random-access memory that allows users to download data or programs for use off-line.

Perhaps the most exciting aspect of Videotex '84 from the personal computer user's perspective was the array of new software products designed to give videotex capabilities to machines like the IBM PC and Commodore 64. These include frame-creation systems for developing videotex displays (typically priced in the $1000 to $1500 range for software alone) as well as decoding software that turns a personal computer into a videotex terminal ($100 to $300).

Notable new products for creating videotex displays were the Picture Painter for the IBM PC, from Cableshare Inc. (London, Ontario); Medianode 8, also for the IBM PC, from Media Videotex Corp. (Vancouver, British Columbia); and Prodraw, an inexpensive but well-designed product from Limicon Inc. (Toronto). Prodraw, which is now available for CP/M systems and should soon come out in an MS-DOS version, will be integrated into the PSI Parti computer conferencing system sometime this summer. Unlike some of the other systems demonstrated at Videotex '84, Prodraw implements the full Service Reference Module of the NAPLPS standard.

Avcor (another Canadian company based in Toronto) created quite a stir with the introduction of its Jordan Videotex Decoder software cartridge for the Commodore 64. Priced at $100, this product makes it possible to put together a videotex decoder/terminal for less than the price of dedicated units (and you have a respectable home computer to boot).

IBM showed its PC/Videotex program, which will give the PC or 128K-byte PCjr the capability to receive videotex displays. PC/Videotex costs $220 for the PCjr and $250 for the PC. Similar (though typically less expensive) software for the IBM PC was also demonstrated by Wolfdata (Chelmsford, Massachusetts), Microstar Software Ltd. (Ottawa, Ontario), and Microtaure Inc. (Ottawa).

Given the diversity of the products and presentations at Videotex '84, making broad predictions is risky, but significant trends are becoming clear. The most obvious is that business applications of videotex are far more polished and marketable than home uses. It seems certain that large business organizations will adopt videotex communications with the same enthusiasm that they have embraced electronic mail and on-line information services.

For consumer applications, the future is less certain. The apparent success of trial videotex services seems promising, but whether fancy graphics and convenient transactions make such systems worth their price is something only time and more extensive implementations will tell. □

## Report from Winter Comdex

New products from many small companies dominated the exhibit halls at Comdex/Winter, a trade show for computer dealers held in early April at the Los Angeles Convention Center. But much of the excitement centered around the activities of the two largest firms in the industry, AT&T and IBM.

AT&T took an entire hall to show its line of computer products, ranging from minicomputers to a multiuser microcomputer. The smallest of six new computers, the $9500 3B2/300, uses the firm's 32-bit WE 32000 microprocessor and Unix operating system and can handle up to 18 users. The telecommunications giant also showed

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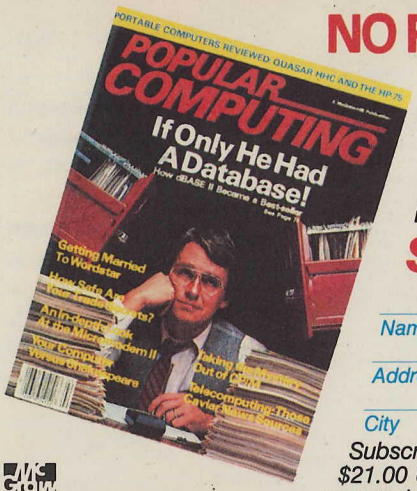
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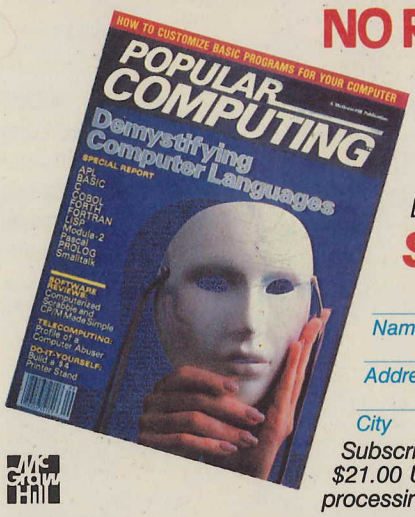



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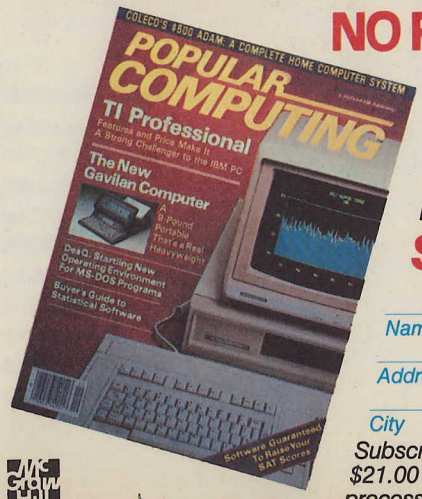
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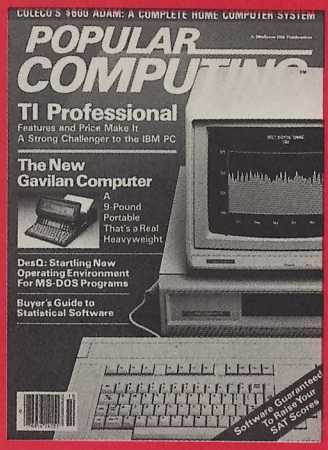
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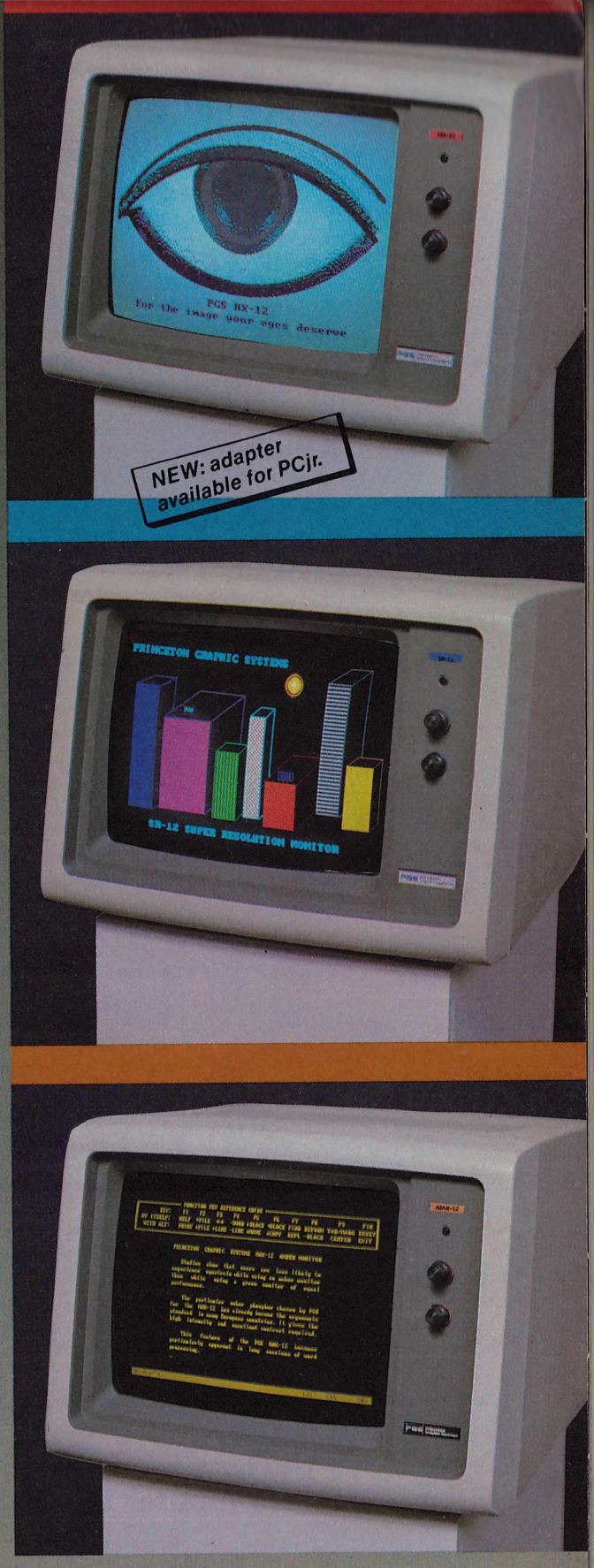
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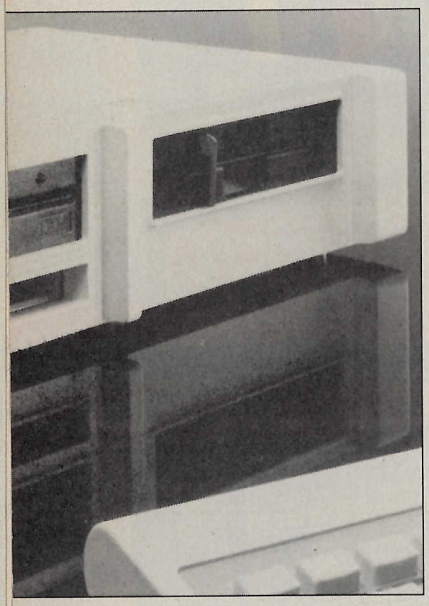
3BNet, a high-speed network that ties IBM computers together and connects the Ethernet network; it will be used to form an electronic messaging service for the 1984 Summer Olympics (For more information on computers and the Olympics, see this month's Cover Story). Additionally, a PC interface connects the 3B2/300 to IBM-compatible personal computers and lets the personal computers share peripherals, such as hard disks and printers, and act as terminals running Unix.

AT&T did not introduce a much-rumored low-priced personal computer at the show. However, Jack Scanlon, Vice President, Computer Systems Division, said the firm plans to extend its hardware offerings "during the rest of this year."



**Falcon Technologies' Extender expands the PCjr.**

IBM, the other industry giant, demonstrated several recently introduced word-processing software packages for its Personal Computer. These programs resemble those used on the firm's dedicated word processors. They include Displaywrite2, a $299 program for the IBM PC, XT, Portable PC, and 3270-PC, similar to Textpack4 programs used on IBM's Displaywriter; and Displaywrite1, a $95 stripped-down version designed for the PCjr. IBM also announced systems that let you transmit documents written in Displaywrite2 at high speeds to other PCs and Displaywriters. A third new text-processing system, PCWriter, includes menus and commands that are similar to those of the firm's Datamaster computer. The $199 program includes a 120,000-word dictionary.

Lesser-known companies displayed some of the more innovative hardware products at the show. You can now add more capabilities to a PCjr with a floppy-disk expansion system from Falcon Technologies (Kent, Washington). The firm's $995 jr Extender adds a double-sided floppy-disk drive and sockets for an additional 256K bytes of RAM and comes in a case that attaches to the side of the PCjr. The unit also comes with a master power module that controls the main PCjr and monitor; an expansion port; an optional plug-in card with a mouse port and a clock; and a version of MS-DOS 2.1. Falcon's founder, Tim Patterson, wrote the original MS-DOS.

A new combination text/graphics display adapter for the IBM PC was introduced by Personal Systems Technology (Irvine, California). The $495 Persyst BoB (Best of Both) board produces a dot resolution of 640 by 200 on both monochrome and color displays and uses a character cell of 10 by 16 dots. This produces clearer text on high-quality color monitors.

Sun-Flex Industries (Novato, California) showed a touch-pen system for the IBM PC and IBM monochrome monitor. With this $1000 system, you put a conductive mesh over the monitor screen and then select points on the screen by using a special touch pen either on the screen itself or on a hand-held tablet. The system, which includes a pen, on-screen mesh, touch pad, and a controller card, is designed for applications such as computer-aided design.

Sord Computer, a Japanese firm, displayed a lap-sized computer with built-in integrated software. The $995 computer includes a Z80A central processor, an 8-line by 40-character liquid crystal display, keyboard, 32K bytes of RAM, built-in cassette recorder, and RS-232C interface. The computer's 64K bytes of read-only memory (ROM) contains database, spreadsheet, calculator, communications, and text-processing programs, and the machine also comes with a word-processing ROM cartridge. Later, Sord plans to introduce a version of the machine with an internal 300-baud modem for $1095.

In the IBM-compatible computer market, Articulate Computers (Costa Mesa, California) will distribute the PC-1600, made by Synco in Taiwan. The $2295 machine comes with an 8088 central processor, 128K bytes of RAM, dual floppy-disk drives, color-graphics adapter, keyboard, and MS-DOS operating system.

On the software side, DSS Development (Bloomfield, Connecticut) introduced a library of 52 applications that go on top of Lotus Development's 1-2-3 spreadsheet. The applications, called OptionWare, cost $130 each and include financial statistics, sales and marketing, personnel, and scheduling. As they contain preset formats, tables, and formulas, all you have to do is enter data, and the system does the calculations.

Dow Jones & Co. (Princeton, New Jersey) showed the first three of seven packages in the Dow Jones Software Accounting Series designed by Trademark Software, (Mountain View, California). These core packages—general ledger, accounts payable, and accounts receivable—cost $1000 each and include a computer training seminar by Arthur Young & Co., the large accounting firm. Dow Jones says that additional inventory, management analysis, sales order entry, and purchase order entry packages will be available in early 1985. □

## New Play "Hackers" Pokes Fun at Computer Users

New York's West 42nd Street, an area best known for its sleaze, recently became home to a play about high tech. Last March, the bawdy avenue's Punch Lane Theater unveiled *Hackers*, a comedy about—you guessed it—computers and the people who program them.

According to Michael Eisenberg, the play's author and an MIT computer science graduate student, the idea was not to cash in on a trendy subject but to bring to light the human side of his favorite pursuit.

"Considering my interests, writing a comedy about computers seemed pretty natural," he says. "We are surrounded by these machines at work and at home. Everybody's talking about them, writing about them."

The play's action takes place in a college's computer lab (the school is unnamed but, as the plot unfolds, the place sounds a lot like MIT). It's late at night and three hackers are busy at their terminals. One is involved in a game of chess, another is finding his way through an adven

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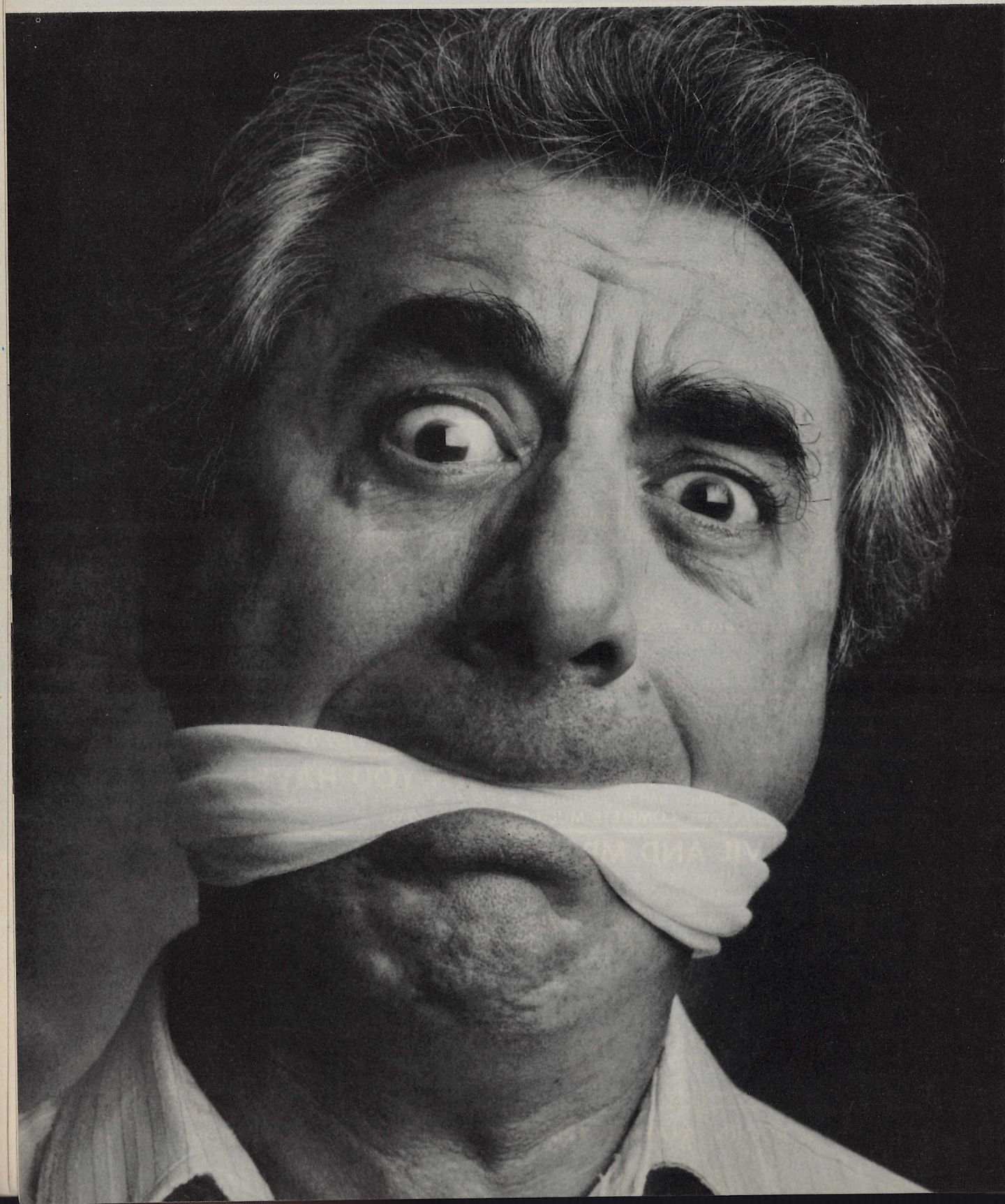

# and data simultaneously, leaves a lot to be desired.

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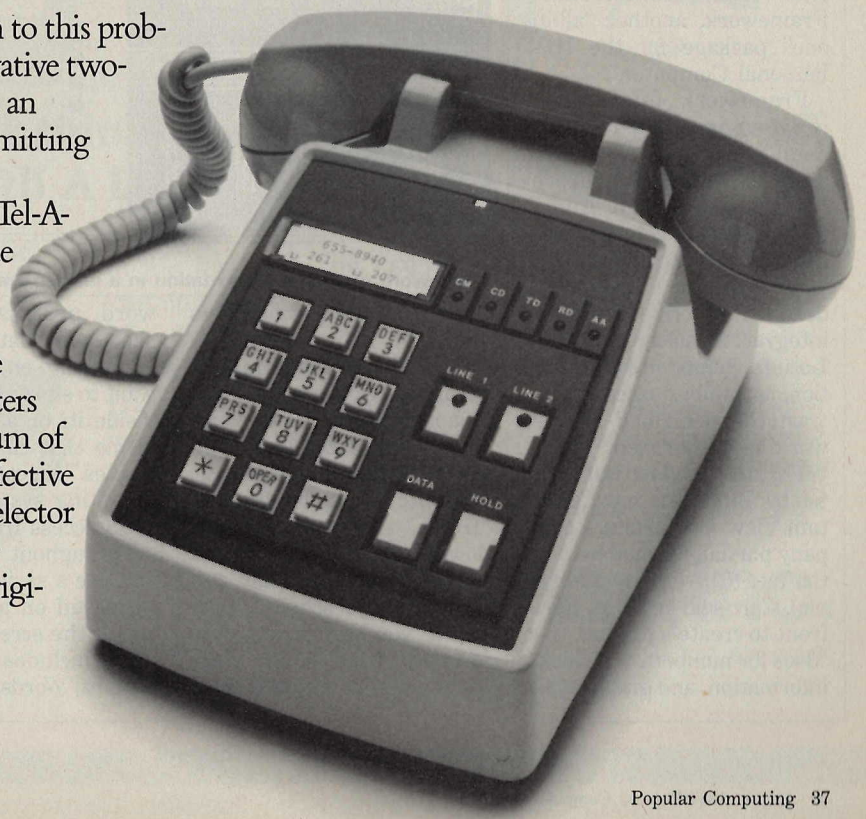


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ture game, and the third is attempting to prove theories of artificial intelligence. The play is about what happens to the computer students and their projects over the span of several months.

"I think hackers are a very interesting group of people," says Eisenberg. "They're a little scary in a way, since they tend to be very obsessive and live within their own isolated culture. But I don't know where modern society would be without them."

Eisenberg, who wrote his play with the help of an MIT mainframe computer and laser printer, believes his work offers a broad appeal to a wide spectrum of theatergoers, not only to those involved with computers. "I think there's a little bit of a hacker in everyone," he notes. "The characters in my play are not that much different from the people you're likely to meet in the street. We're all compulsive about something, and my characters just tend to be obsessed with computers." □

## Binary Bartender

Having job troubles? Your family doesn't understand you? Pull up a stool and tell your problems to your friendly neighborhood bartender. But you better hurry if you hope to find a compassionate ear, for if one Silicon Valley-based entrepreneur has his way, flesh-and-blood barkeeps may soon give way to units made of plastic and silicon.

Meet Scarab X1, a robot bartender that draws beer, dispenses wine, and mixes everything from martinis to piña coladas. The $65,000, 8-foot-high unit, which vaguely resembles an extra-wide telephone booth with spigots, is the brainchild of Ron Meyer, a 54-year-old former hospital equipment manager. According to Meyer, the idea is to provide tavern and restaurant owners with a cost-effective solution to rising salary costs.

"When you consider how much money bartenders demand these days, Scarab is a bargain. We feel the unit brings bartending into the world of high technology, providing users with yet another element of their business that can be computerized," Meyer says. "There's also a certain measure of show business to this thing," he admits. "I'm sure many buyers will purchase the system with an eye toward the publicity it will generate."

Customers talk to Scarab with the help of a hand-held radio transceiver. A cheery "May I have your order?" greeting lets you know the unit is ready to begin work. A speech-recognition system within the robot bartender, as well as a microprocessor and mechanical arm, converts customers' verbal commands into drinks. Refreshments can be picked up at the bar or delivered by a waiter or waitress. "That part is up to the system owner," says Meyer.

While Meyer is optimistic about Scarab's future, he admits the system "still needs to get a few bugs ironed out." At a press demonstration, the unit spilled more beverages onto the floor than it poured into glasses. "Beer—with all that foam—poses the biggest problem," Meyer says. □

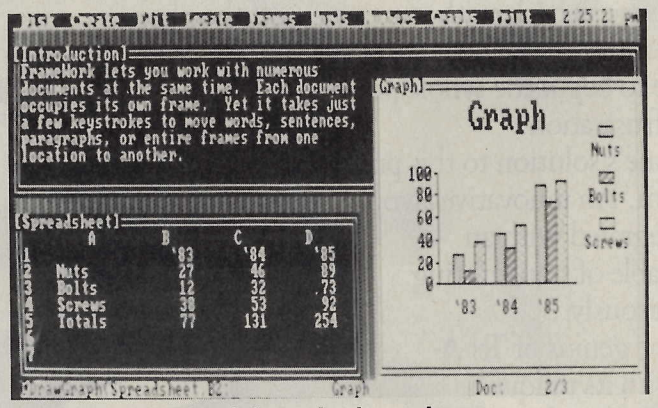
## ASHTON-TATE INTRODUCES FRAMEWORK

Integrated software suppliers such as Lotus Development Corp. and Ovation Technologies may find new competition from Ashton-Tate's Framework, another "all-in-one" package for the IBM Personal Computer.

Framework offers word processing, spreadsheet, database, and graphics capabilities as well as its own programming language. And it uses a series of common commands for all the applications.

Robert Carr, Framework's designer, described the other integrated packages, such as Lotus's Symphony and Ovation, as number-based; in contrast, he described Framework as word-based.

The new product was written by Forefront Corp. (Mountain View, California), a company partially owned by Ashton-Tate (Culver City, California). Carr said he set up Forefront to create a product that "does for numbers, text, ideas, information, and graphs what spreadsheets do for numbers alone."




**Framework organizes information in a unique way.**

Using Framework's outline capability, you can divide a task into several items, which you can organize like an outline on paper. Each item in the outline can be its own "frame," similar to the windows used in other packages, except that you can put frames inside other frames, just as you have layers of information in an outline. Each frame can be defined as a word processing, spreadsheet, or database frame, depending on the way you want to store the information inside it, or as a containing frame that can group other frames. You can even use the operating system through a DOS access frame.

Throughout the program, you use a series of functions displayed on a menu at the top of the screen. This main menu includes items such as Graphs, Words, and Frames; when you select an item, it displays a submenu with the different commands in each area. Such pull-down menus resemble those used in products like Apple Computer's Macintosh except that Framework does not use a hand-held mouse pointing device.

The one major function that the program lacks is communications. The system reads and writes standard ASCII text files to disk, which can then be used by most communications packages.

Framework requires a minimum of 256K bytes of RAM and two disk drives. On a 256K-byte machine, the program leaves a working area of about 100K bytes, so it can work with about 35 pages of text, 200 to 400 database records, or a spreadsheet of about 2000 cells. On larger machines, the memory-based program can handle larger files. Framework is scheduled to sell for $695 and be available on July 2. □

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*Please* will supply you with labels for a mailing to selected customers. It can send customer information to your word processor for a promotional letter. And it can receive data from your spreadsheet program. *Please* will even look up a name and company for you, your Hayes Smartmodem* will dial the phone number, and you're ready to talk!

Taking this same sales database, you might also want to define special fields for a custom Output Plan. With a defined field for "COMMISSIONS DUE," *Please* can automatically compute each salesman's commissions, and print them out in a report of your own design. All this and more, just for saying "Please."

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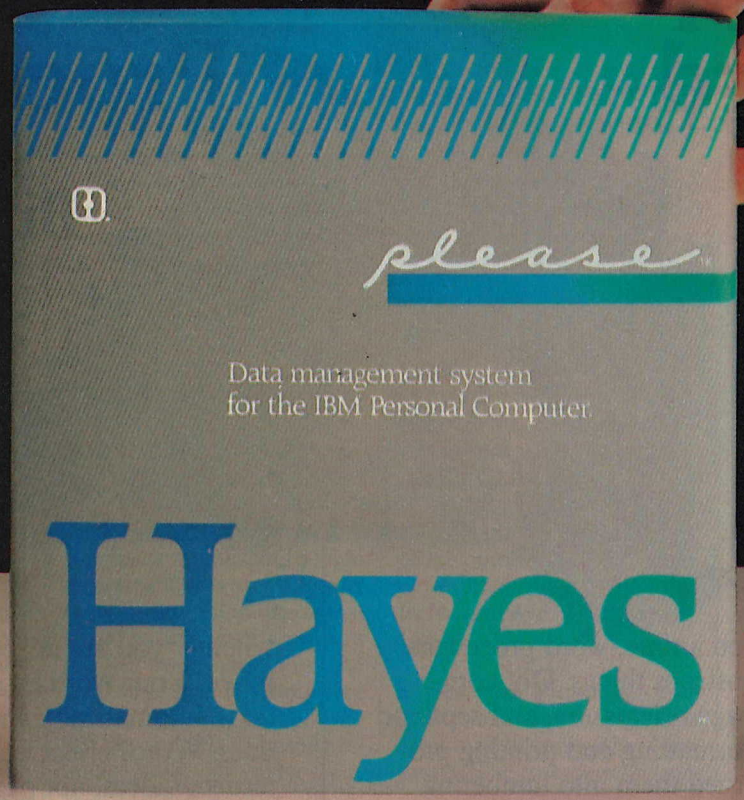


**"Put it here, Please."**
**Design a special screen format to position data in a particular place.**

knowing all that storage power is there? Just in case you ever need it?

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**dProgrammer** is a complete double-entry accounting system written in dBASE II and an applications generator. The package offers general ledger, accounts receivable and payable, and customer and vendor ledger modules. It also features five journal registers, a balance sheet, income and budget variance statements, and a variety of helpful internal reports. For the **IBM Personal Computer** and **CP/M-**, **CP/M-86-**, and **MS-DOS-based** systems; $295; requires dBASE II and 300K bytes of memory. Sensible Designs, 5244 Edgepark Way, San Diego, CA 92124.

**Integrated-6** provides six popular business applications in one package. Included are a relational database, presentation graphics, an electronic spreadsheet, a word processor, a telecommunications program, and a terminal emulator. You can transfer data between programs. For the **IBM Personal Computer;** $495. Mosaic Software, 1972 Massachusetts Ave., Cambridge, MA 02140.

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**R:base 2000** is a scaled-down version of the R:base 4000 and 6000 relational database systems. Features include simple commands and a wide assortment of search and sort capabilities. Files are transportable among programs in the R:base series. For the **IBM Personal Computer** and **PCjr** and **MS-DOS**, **CTOS-**, and **BTOS-based** systems; $295. Microrim Inc., 1750 112th Ave. N.E., Bellevue, WA 98004.

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**Series One Plus** is an integrated software package that combines 12 applications programs. The core package contains word-processing, database management, spreadsheet analysis, and utilities programs. Optional modules include a four-program financial management system, a report writer, an IBM Personal Computer to 3780 mainframe communications link, and a graphics package. All modules share the same commands and files. For the **IBM PC**, **Durango Poppy**, **Pronto Series 16**, **DEC Rainbow**, **Wang PC**, and other **MS-DOS-based** systems; $495. Executec Corp., 12200 Park Central Dr., Dallas, TX 75251.

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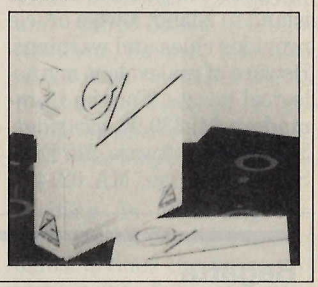
*A financial control tool, Oz offers integrated data analysis, graphics, and report modules that allow managers to view data from various perspectives. A built-in variance analysis system pinpoints and explains budget variances. For the **IBM Personal Computer;** $495. Fox & Geller Inc., 604 Market St., Elmwood Park, NJ 07407.*



New Software provides up-to-date listings of recent releases in microcomputer software. Descriptions are based on information supplied by the manufacturers and are not to be considered endorsements of the products. Companies continually offer new versions of popular programs for different machines. Please check with the manufacturer or a dealer to find out if a program is available for your computer. For in-depth evaluations of some of these programs, see our Software Review section.

tional Corp., 33 San Pablo Ave., San Rafael, CA 94903.

## Games

**Aegean Voyage** places you in command of a fleet of three Greek sailing ships that are searching for the treasures of the gods. As you travel from island to island, a wise oracle provides clues and warnings. Beware of malevolent mythological beasts. For the **Commodore 64;** $39.95, cartridge. Spinnaker Software, 215 First St., Cambridge, MA 02142.

**Conquest** sends you back in time to an era when giant reptiles and birds ruled the earth. As a prehistoric falcon, your aim is to fly higher than your enemy. Keep an eye out for bonus-point pterodactyl eggs and ill-tempered dragons. For one or two players.

### Regatta

*A one- or two-player sailing simulation, Regatta offers four realistic race courses. Players set sails, control their boat's tiller, and race against each other and an on-screen clock. As in actual competition, penalty points are given for hitting a buoy or running aground. For the* ***Apple II;*** *$29.95 Howard W. Sams & Co., 4300 West 62nd St., Indianapolis, IN 46268.*

**Bank President** is a simulation designed for present and aspiring business executives. As the chief executive officer of a large commercial bank, you must plan strategies, make top-level decisions, and attempt to outperform the competition by raising the value of your bank's stock. You can play alone, against the computer, or with others. For the **IBM Personal Computer** and **PCjr, Apple II, IIe,** and **Macintosh;** $74.95. Lewis Lee Corp., POB 51831, Palo Alto, CA 94303.

**Competition Racing** pits your team against the cars of an opponent. You must cope with such factors as gear limits, curve markers, tire wear, pit stops, and caution lights. The program includes a graphic menu, counters and indicators, and realistic sound effects. For the **Apple II** and **IIe** and **Franklin Ace;** requires paddles or joystick; $32.50. Apple-Pi Micro, 3166 Patsy Dr., Beavercreek, OH 45385.

For the **IBM Personal Computer;** $39.95; requires color graphics adapter card. Windmill Software Inc., POB 1008, Burlington, Ontario L7P 3S9 Canada.

**Hes Games** 84 brings Olympic competition to your home. Using animated characters and sound effects, this game features weight lifting, diving, running, the long jump, archery, and hurdles events. It includes instant replay, and players can save their best performances. For the **Commodore 64;** $39.95, disk. Human Engineered Software, 150 North Hill Dr., Brisbane, CA 94005.

**Macmanager**, a business simulation, puts you at the helm of a company in a hypothetical industry. Maximize your profits by making decisions based upon supplied financial data. Graphics help you monitor plant capacity, production levels, and inventory. For the **Apple Macintosh;** $49.95. Harvard Associates Inc., 260 Beacon St., Somerville, MA 02143.

**Peril** is a text adventure game of combat beneath the earth. You wander the maze, amassing gold and jewels while fighting 30 monsters. A different maze is created each time you play. For **Radio Shack TRS-80 Models I** and **III;** $9.95. K & C Enterprises, POB 1072, Bloomington, IN 47402.

**Quotrix** challenges you to beat the computer at guessing famous quotations. Armed with the quote's author and format, you must follow a trail of crossword puzzles, trivia questions, foreign word translations, and riddles as you attempt to uncover the complete phrase. For the **IBM Personal Computer, PCjr, Apple II, IIe,** and **Commodore 64;** $34.95. Insoft, POB 608, Beaverton, OR 97075.

**Run for the Money**, an action game that two can play at once, hones business and strategy skills as you attempt to finance the repair of your spaceship's reentry shield. Learn how to develop a business, make a profit, purchase raw materials, and allocate resources. For the **IBM Personal Computer;** $49.95. Scarborough Systems, 25 North Broadway, Tarrytown, NY 10591.

**Sorcerer of Claymorgue Castle** is an adventure game with a medieval theme. The thirteenth installment in Scott Adams's popular Adventure series, the game puts you in the shoes of Beanwick, faithful apprentice to master wizard Solon. Using the traditional verb/noun commands, you search for the 13 Stars of Power. For the **Commodore 64, Apple II, Radio Shack TRS-80 Models I, III, 4,** and **Color Computer,** and **Ataris;** $19.95, cassette; $24.95, disk. Scott Adams Inc., POB 3435, 155 Sabal Palm Dr., Longwood, FL 32750.

**Space Spikes**, an arcade-type game, puts you in combat against falling projectiles, kamikaze pilots, and deadly laser batteries. The action takes the form of ground-to-air, air-to-air, and air-to-ground battle. For the **Apple II** and **IIe;** requires joystick; $20. Three Sigma Inc., POB 716, Morrisville, PA 19067.

**Wordtrix** is an educational game that helps expand your vocabulary. Attempt to form words from a grid of random letters before the clock runs out. A built-in dictionary checks your results. For the **IBM Personal Computer, PCjr, Apple II, IIe,** and **Commodore 64;** $34.95. Insoft, POB 608, Beaverton, OR 97075.

## Education

**BASIC Jr** teaches the fundamentals of BASIC programming to anyone age 10 and up. Topics include loops, branching and input statements, animation, dimensional arrays, and random number generators. Also included is an interactive graphics utility that lets you draw and paint lines and shapes, rotate and move objects, and add graphics routines to BASIC programs. For the **IBM Personal Computer** and **PCjr;** $49.95. Courseware Inc., 10075 Carroll Canyon Rd., San Diego, CA 92131.

**Evolution** is a simulation that lets students view the effects of mutation, gene flow, natural selection, and genetic drift on populations. Students can study these factors individually or within combinations as they simulate successive generations. A booklet describing each evolutionary factor is included. For the **Apple II** and **IIe;** $29.95. Oakleaf Systems, POB 472, Decorah, IA 52101.

**Fay: The Word Hunter** is a word search game that reinforces spelling skills. Players swim through an underwater world as they direct scuba diver Fay to a sizable stockpile of hidden words. Help Fay defend herself against sharks, crabs, and a diabolical submarine. The game contains a dictionary of 3000 words. For the **Apple II** and **IIe**; $34.95. Didatech Software, 549-810 West Broadway, Vancouver, BC V5Z 4C9 Canada.

**Knoware** teaches new computer users six of the most popular business applications. Tutorials cover graphics, BASIC programming, database management, spreadsheets, text editing, and financial decision making. The program uses positive-reinforcement techniques and arcade-like games to enhance the learning process. For the **IBM Personal Computer** and **XT**; $95. Knoware Inc., 301 Vassar St., Cambridge, MA 02139.

**Monkeynews**, designed to help increase reading and comprehension skills, allows youngsters to control story direction, pace, and the action of the main character. A branching program creates more than two dozen variations for each story. Color character animation helps to hold youngsters' attention. For grades 1 through 6. For the **Apple II**, **Ataris**, and **Commodore 64**; $29.95. Artworx Software Co., 150 North Main St., Fairport, NY 14450.

**Perplexity** is designed to develop players' logic and problem-solving skills. Three puzzles, each with two difficulty levels, are offered. The programs are drawn from the award-winning Comp-U-Solve computer games package that is used by many schools. For the **Apple II** and **IIe**, **Commodore 64**, and **Radio Shack TRS-80 Models III** and **4**; $29.95. Daybreak Software, 1951 Grand Ave., Baldwin, NY 11510.

**Ranch** is a game generator that lets 5 to 10 year olds create their own Western-oriented graphic adventures. Players can illustrate their creations with a variety of people, critters, and shapes. The program also offers a simple animation editor and three types of musical effects. For the **Commodore 64**; $39.95, cartridge. Spinnaker Software, 215 First St., Cambridge, MA 02142.

**Stickybear Shapes** helps children ages 3 to 6 learn to recognize the shapes of common objects. When a correct choice is made, the child is rewarded with an animated display. Includes a 32-page *Shapes* book, stickers, and a poster. For the **Apple II** and **IIe**; $39.95. Xerox Education Publications, Computer Software Division, 245 Long Hill Rd., Middletown, CT 06457.

**The Road to Eco-Paradise** uses a game-quiz approach to educating players about ecology and environmental issues. It challenges you to travel from the City of Darkness to Eco-Paradise without falling into a nasty toxic waste dump or getting trapped into lengthy detours. Along the way, you answer questions on air and water pollution, acid rain, toxic chemicals, environmental policies, and a variety of other key issues. For the **Apple II**, **IBM Personal Computer**, and **CP/M-based** systems (**Osborne**, **Kaypro**, **Televideo**, and **8-inch** formats); $39.95. Center for Science in the Public Interest, 1755 S Street N.W., Washington, DC 20009.

**Writing Is Thinking**, designed to teach sound writing skills, divides the process of writing into four categories: planning; structuring and outlining; writing paragraphs; and rewriting, revising, and editing. The content of the program has been adapted from a junior-college-level writing course. For the **IBM**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Admiral Bobby Ray Inman, Director, Microelectronics and Computer Technology Corporation.
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the computer chronicles

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July 2, UTILITIES with Peter Norton
July 9, GAMES with Bill Budge & Steve Kitchen
July 16, PEOPLE with Steve Wozniak & Adam Osborne
July 23, FIFTH GENERATION
July 30, SUPER COMPUTERS

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**Personal Computer;** $165. Kapstrom Inc., Suite 124, 5952 Royal Lane, Dallas, TX 75230.

## Home

**The Computer Chef,** a cookbook program, contains over 70 recipes ranging from appetizers to desserts. The program automatically adjusts recipes according to the number of servings needed and helps you plan meals based on ingredients on hand. Optional databases provide additional cooking ideas. You can add your own recipes to the system. For the **IBM Personal Computer, PCjr,** and **CP/M-based** systems; $29.95. The Software Toolworks, 15233 Ventura Blvd., Sherman Oaks, CA 91403.

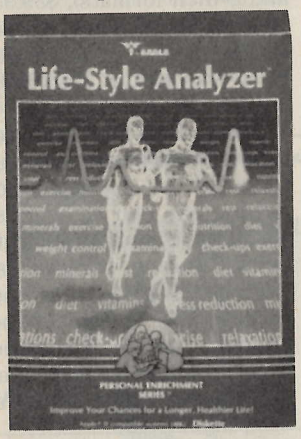
**Coping with Stress** teaches users how to deal with common normal and abnormal bouts of daily stress. The program is based on cognitive therapy techniques. Ten progressive lessons help you learn to lead a more relaxed life. For the **IBM Personal Computer** and **Apple II** and **IIe;** $89.95. Psycomp, 22055 Clarendon St., Woodland Hills, CA 91367.

**Diary 64** is a database program that lets you keep track of telephone numbers, addresses, and appointments. With its printout routine you can print address labels or a variety of other lists from information in the database. The program saves data to disk or tape. For the **Commodore 64;** $29.95, cartridge. Handic Software Inc., Suite 7, 5090 Central Highway, Pennsauken, NJ 08110.

**Darkstar Plus** solves a variety of commonly encountered photographic darkroom problems. It provides exposure data for changes in print density, magnification, emulsion baths, filters, and a variety of other applications. Also included is a timer program allowing control of up to 15 sequential periods. For the **Apple II, Kaypro II, Ataris;** $89.95, disk; for the **Commodore 64;** $74.95, cassette. F/22 Press, POB 141, Leonia, NJ 07605.

**The Eating Machine** helps you manage your diet. The program, with an expandable database of 500 common foods, offers information on your vitamin, calorie, fat, calcium, protein, iron, and nutrient intake. You can get an analysis of your food intake for up to seven days at once. For the **Apple II** and **IIe;** $49.95. Muse, 347 North Charles St., Baltimore, MD 21201.

### Life-Style Analyzer




*Capable of identifying potential health problems, this program evaluates health habits, exercise routines, medical history, and family background and then pinpoints health risks and suggests corrective steps. For the **IBM PC** and **PCjr, Apple II** and **IIe,** and **Commodore 64;** $34.95. Eagle Software Publishing, 993 Old Eagle School Rd., Wayne, PA 19087.*

## Graphics

**APS Graph** can produce line, bar, stick, and step graphs, pie charts, and scatter plots. This menu-driven program can read data files from many popular database and spreadsheet programs and works with most high-quality printers and plotters. For **CP/M-based** systems; $295. Automated Professional Systems, 270 Madison Ave., New York, NY 10016.

**Fontastic** works with your dot-matrix printer to create special character fonts, graphics characters for headings, diagrams, and charts. The program also offers word-processing forms control and proportionalized printing. Diagrams can be printed as part of text in a standard DOS file. You can design custom fonts and add them to a font library. The program works with most word processors and dot-matrix printers. For the **IBM Personal Computer;** $125. IHS Systems, Suite 211, 4718 Meridian Ave., San Jose, CA 95118.

**Graph-Art System I** helps you create video pictures for entertainment, business, or artistic applications. The program offers mixed graphics and text, a tracing sheet, slide-show organizer, fast eraser, and inverse picture producer. For the **Apple II** and **IIe;** $34. Apollo Software Technology, POB 34057, Houston, TX 77234.

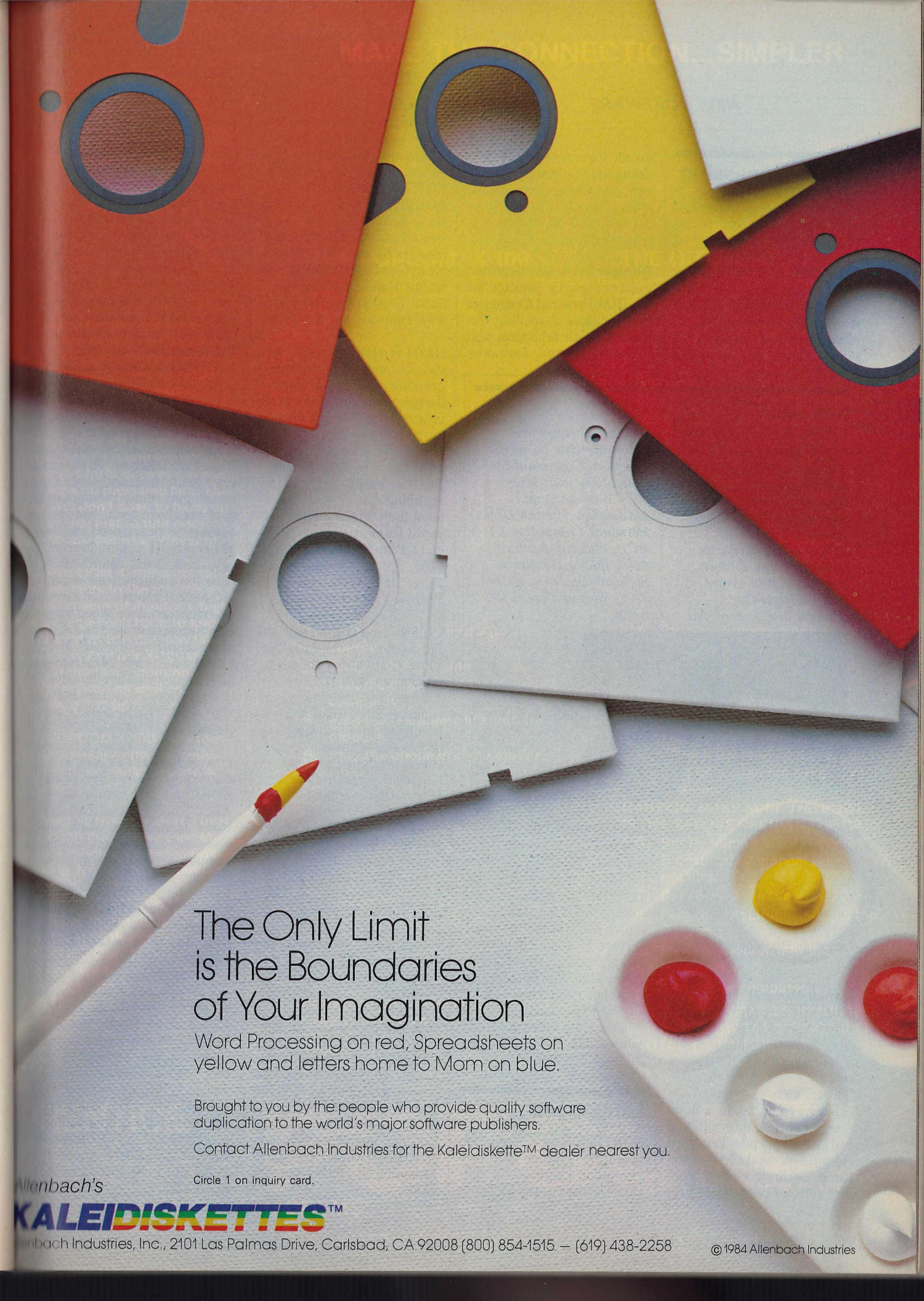
**Microsoft Chart** makes possible the preparation of presentation-quality charts from Visicalc, Lotus 1-2-3, dBASE II, and Multiplan data files. The system features size, appearance, and position controls, 45 chart forms, and online help screens. It also allows mixed text and graphics. For the **IBM Personal Computer, XT, PC Portable,** and **Compaq;** requires color graphics adapter; $250. Microsoft Corp., 10700 Northup Way, Bellevue, WA 98004.

**Pattern Maker** lets you weave graphic patterns on your computer's display. The images can be duplicated, expanded, contracted, rotated, and edited. Besides creating beautiful designs, the program also teaches you about mathematical design relationships. For the **Apple II** and **IIe;** $39.95. Scarborough Systems Inc., 25 North Broadway, Tarrytown, NY 10591.

**P.B.G.,** a business graphics system, works with many plotters and produces bar, pie, and line graphs, text screens, and population pyramids. Designed to be learned in an hour, this program can help you create graphs in minutes. For the **IBM Personal Computer, XT,** and compatibles, requires two disk drives and a color-graphics adapter card; $395. Ganesa Group International, Inc., Suite 300, 1495 Chain Bridge Rd., McLean, VA 22101.

**PC-Draw** is an interactive drawing system that provides you with three symbol libraries (software design, electronics design, and alternate text), multiple text fonts, and the capability to design your own symbols. Functions include object scaling, rotation, and placement. Outputs can go to printer or plotter. For the **IBM Personal Computer** and **XT;** $295 ($445 with light pen; $100 for plotter-support module). Micrografx, Suite 703, 1701 North Greenville Ave., Richardson, TX 75081.

**Pixit** is a picture-creating program that contains a shape table editor, a font library, and a picture editor. You can create a picture using mixed text and graphics, circles and lines, and selections from the shape tables. You can print the design or save it on disk for use in other programs. For the **Apple II, IIe,** and **III** in emulation mode, **Franklin Ace,** and **IBM Personal Computer** with Quadram's Quadlink; $49.95. Baudville, 1001 Medical Park Dr. S.E., Grand Rapids, MI 49506.



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## Word Processing

**PFS:Proof**, a combination spelling checker and proofreading program, is designed to work with PFS:Write and other ASCII text-file-based word processors. The program, which has a 100,000-word dictionary to which you can add your own words, finds misspellings and corrects them. It also looks for irregular capitalization, double words, and typos. Corrections can be made with a single keystroke. For the **IBM Personal Computer;** $95. Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94043.

**Samna Word III** is a word-processing program that offers user-defined function keys, automatic indexing, section numbering, and a table of contents generator. It also features a keyboard-to-printer typing mode, a mail/merge routine, international and special-purpose keyboard characters, and tree-structured file directories and subdirectories. For the **IBM Personal Computer** and **XT, Compaq, Columbia, Corona,** and **Colby** compatibles; $650. Samna Corp., Suite C-1200, 2700 Northeast Expressway, Atlanta, GA 30345.

**Wordperfect** is an integrated word-processing package for the **IBM Personal Computer** that includes a spelling dictionary, math functions, text columns, macros, footnotes, multiple-line headers and footers, and proportional spacing. This program shows boldface text, centering, underlining, margins, and spacing on-screen as text is typed; $495. **Personal Wordperfect** is a condensed version of the more powerful program; $195. **Wordperfect Jr**, a further condensed version for the **PCjr**, is available for $69. Satellite Software International, 288 West Center St., Orem, UT 84057.

### Newword

*In addition to a full array of editing functions and formatting capabilities, this word-processing program has an unerase command that recovers deleted text with one keystroke, an undo function to override command errors, and multiple-line headers and footers. All 40 function keys are programmable by menu selection. Command-file compatible with Micropro's Wordstar and Mailmerge. For the **IBM Personal Computer, XT, PCjr,** and compatibles; $249. Rocky Mountain Software Systems, POB 3282, Walnut Creek, CA 94598.*

## Languages

**FORTH 64**, a combination operating system and programming language, is suitable for almost any business application. Features include an interactive structured program environment, extendable language structure, text editor, and macro assembler. FORTH 64 is a standard fig-FORTH with many extensions including double-precision arithmetic. For the **Commodore 64** and **VIC-20** with 3K bytes of RAM; $39.95, cartridge. Handic Software Inc., Suite 7, 5090 Central Highway, Pennsauken, NJ 08110.

**GL/M** is a language that lets you to create customized graphics on an assortment of daisy-wheel and dot-matrix printers. Images are formed by GL/M program statements, which are contained in an ordinary text file. Graphics can be easily tailored by changing one or more statement lines. For the **IBM Personal Computer** and **CP/M-** and **CP/M-86-based** systems; $195. Aspect Graphics Software, 167 Worcester Rd., Wellesley, MA 02181.

**Professional BASIC** uses the full memory of the IBM Personal Computer while supporting an 8087 coprocessor. This window-oriented system contains more than a dozen tracing and debugging screens, a dynamic syntax-checking ability, and labeled GOSUBs, cross-referencing, and setting breakpoints. For the **IBM Personal Computer;** $345. Morgan Computing Co., Suite 210, 10400 North Central Expressway, Dallas, TX 75231.

**Super Extended BASIC**, a collection of more than 100 subroutines, enhances the power of TI Extended BASIC. Features include a sophisticated sorting function, string array translations, data compaction, a windowing capability, and integer storage, retrieval, and interaction. For the **Texas Instruments 99/4A;** $99.95, disk; requires TI Extended BASIC cartridge and the 32K-byte memory expansion. J&KH Software, 2820 South Abingdon St., Arlington, VA 22206.

## Technical Tools

**Crossave** enables transfer of files between floppy- and hard-disk drives. The system offers high-speed data transfers, selective file backup and restore functions, automatic volume management, and a data-compression mode that packs more data onto a floppy disk than ordinarily possible. For the **IBM Personal Computer, XT,** and compatibles; $99. Award Software Inc., 236 North Santa Cruz Ave., Los Gatos, CA 95030.

**Datasafe** is a data-encryption program that protects files from unauthorized users. Based on DES, an IBM encryption format designed for use on government computer systems, the program lets you establish passwords with either ASCII or hexadecimal keys and check confidential data for unauthorized entry attempts. Protected data can be transferred between any computers that use the DES algorithm. For **CP/M-, CP/M-86-,** and **MS-DOS-based** systems; $135. International Microcomputer Software Inc., POB 2643, San Anselmo, CA 94960.

**Power Tool** allows users to examine and modify TRS-DOS- and LDOS-formatted disks. The program can restore, format, and back up disks and disk segments. The manual assumes users are familiar with TRSDOS or LDOS. For the **Radio Shack TRS-80 Models I, III, 4,** and **4P;** $49.95. Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

**RX Set**, a print utility designed for use with the Epson RX-80 printer, lets you set control codes through a series of interactive screens. The program handles page length, margins, line and character spacing, and print fonts. It cannot handle graphics. For the **IBM PC, XT, PCjr,** and compatibles; $15.25. On-Disk Software, POB 382, Lincoln, MA 01773. □



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3. Plug the modem into the computer.
4. Plug the telephone line into the modem.
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5. Carefully open the case of your modem.

CAUTION: MAKE SURE THE POWER IS OFF BEFORE OPENING THE CASE.

6. Set the eight binary switches (consult your manual for details).
7. Carefully close the case.
8. Plug the telephone line into the modem.
9. Plug the modem into the computer.
10. Turn on the computer.

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## MODEMS

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## Getting the Jump

*The Headstart multiuser computer*

Intertec has unveiled Headstart, a multiuser business-oriented computer that offers dual Z80A and 8086 microprocessors as well as CP/M-80 and MS-DOS compatibility.

The basic system includes 128K bytes of random-access memory (expandable to 1 megabyte), a 105-key detached keyboard, parallel and serial interfaces, and a 12-inch green-screen monitor. Options consist of one or more 3½- or 5¼-inch floppy-disk drives, 10- and 50-megabyte hard-disk storage systems, and a memory-based disk emulator.

A built-in local area network allows users to link together as many as 255 Headstart workstations through a high-speed coaxial interface. The system provides password generation, electronic mail, individual workstation log-on/off capability, programmable security levels, time-slicing, and programmable access priority settings.

Headstart is available in a variety of configurations. A 128K-byte version without disk storage capability, intended as a network workstation, sells for $1795. A 3½-inch floppy-disk-based unit with 512K bytes of memory is priced at under $3500.

Complete details are available from Intertec, 2300 Broad River Rd., Columbia, SC 29210.

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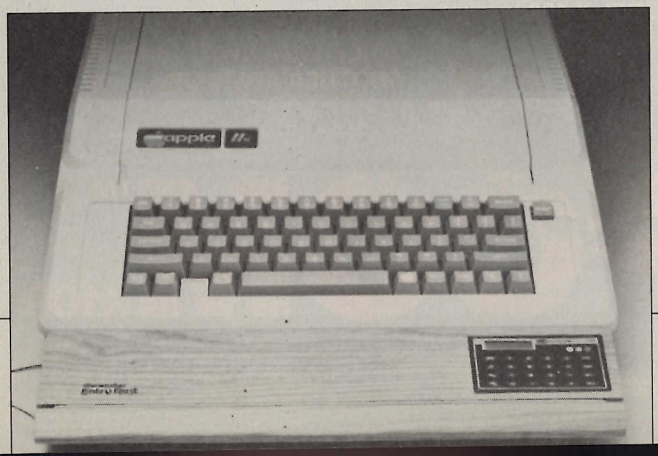


## Taking It Easy

*Entry Rest helps take the fatigue out of data entry*

Discwasher's Entry Rest system helps Apple II users avoid arm, wrist, and shoulder fatigue. The $34.95 solid oak unit includes a multifunction calculator with memory, a grounding bar that protects the computer against static discharges, and mounting hardware.

Complete details are available from Discwasher, POB 6021, Columbia, MO 65205.

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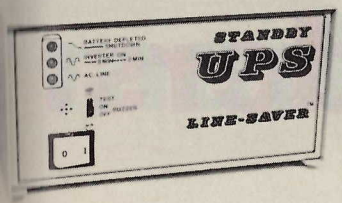


## Don't Interrupt

*The Aegis LS-240 automatic power backup system*

The Aegis LS-240, an uninterruptible power system, protects computer users against data loss caused by unexpected power drops and AC-line transients. When disaster strikes, the unit's internal battery provides 5 to 10 minutes of emergency power for an orderly, data-saving system shutdown.

Priced at $395, the 150-watt unit offers spike and electromagnetic interference filters, audible and visual power-failure warning systems, and external battery connectors. It also includes a test mode indicator and switch, replaceable external fuses, and a 6-foot detachable heavy-duty grounded extension cord.

For further details, write Kalglo Electronics Co. Inc., 6584 Ruch Rd., East Allen Twp., Bethlehem, PA 18017.
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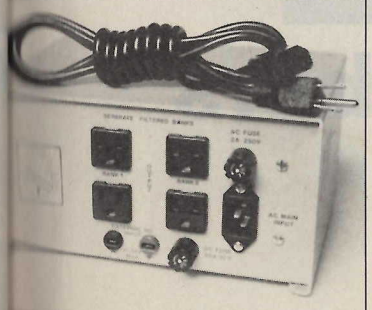


## Recording It

*Double-function tape recorder from Quasar*

Quasar has introduced the GF3134, a tape recorder that's suitable for both data storage and home recording applications.

Priced at $56.95, the recorder features a three-position function switch with two data settings (speaker on or off). Also included are fast-forward and rewind controls that override the computer's stop command, and a digital counter.

When in one of the data modes, the recorder's tone control is bypassed and its volume control's range is limited, providing an enhanced program-loading condition. A two-position phase-selector switch allows users to match the loading signal on most commercially available software tapes to their particular computers.

This versatile recorder is also equipped with a built-in microphone, an AC adapter, automatic stop, and locking pause button.

For further information, write Quasar Co., 9401 West Grand Ave., Franklin Park, IL 60131.
**Circle 203 on inquiry card.**

## Underextended?

*Add five feet of length to your keyboard cable*

Is your IBM Personal Computer's keyboard cable keeping you closer to your machine than you would like? If so, you'll certainly be interested in Bytes & Pieces' Keyboard Extender, an extension cable that adds five feet to the length of your PC's cable. The unit is IBM-plug-compatible and sells for $19.95 (plus $2 shipping and handling). For additional details, contact Bytes & Pieces, 550 North 68th St., Wauwatosa, WI 53213.
**Circle 205 on inquiry card.**

## Think Thin

*Thinprint 80—a lightweight portable printer*

Axonix Corp. has announced Thinprint 80, a battery-powered thermal graphics printer that weighs four pounds and can fit into a briefcase.

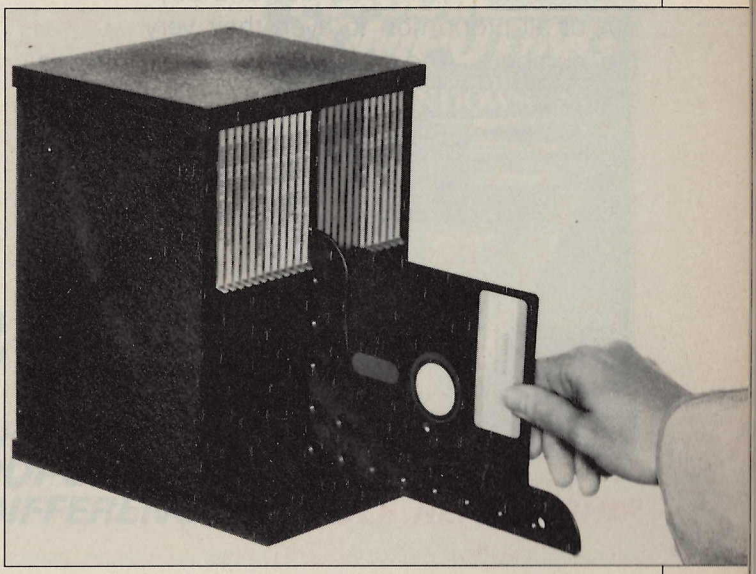
The unit offers a 40-character-per-second bidirectional print speed, 80- and 136-column outputs, and a 2.5K-byte buffer. Other features include a 5- by 7-dot matrix, a parallel or serial interface, and the ability to accept single-sheet or roll paper. Each line has a dot-addressable resolution of 960 by 7 dots, which permits creation of graphs, charts, and digitized pictures. Thinprint 80, priced at $279, has rechargeable batteries, an AC adapter; and an 80-page roll of paper.

For additional details, contact Axonix Corp., 417 Wakara Way, Salt Lake City, UT 84108.
**Circle 204 on inquiry card.**

## Floppy File

*The Flexible Disk File for 5¼-inch floppy disks*

The Flexible Disk File safely and conveniently stores up to twenty-five 5¼-inch floppy disks. Priced at under $40, the unit offers instant disk access, a complete set of identification labels and file tabs, and an antistatic environment. Additional details are available from Eddie Goodwin Co., POB 470331, Miami, FL 33147.
**Circle 206 on inquiry card.**



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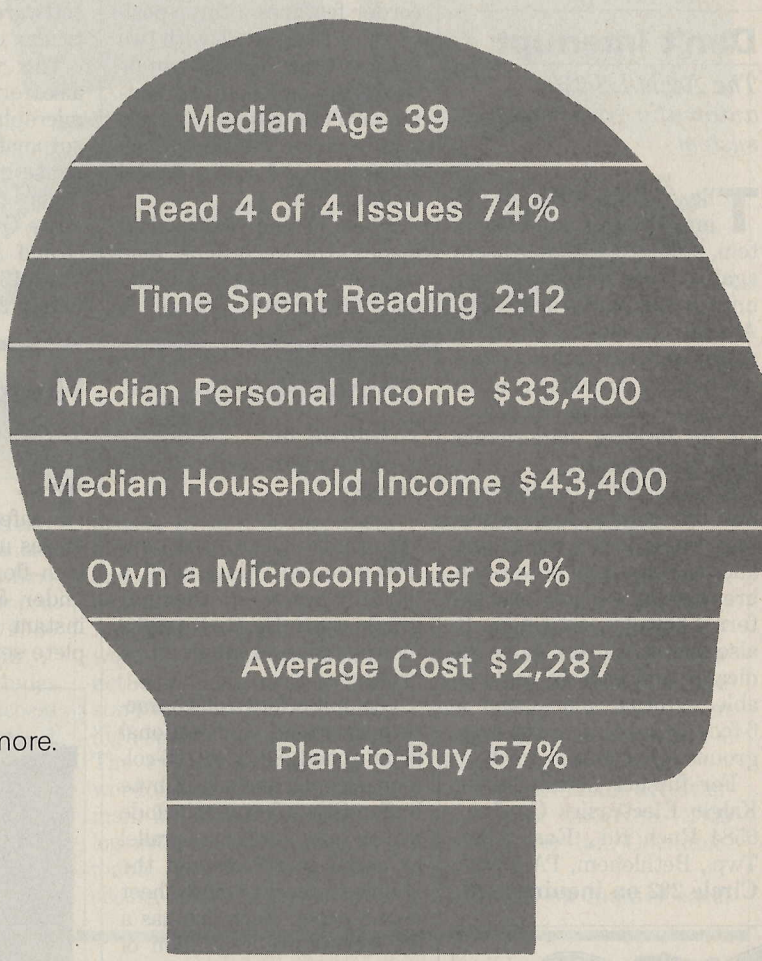


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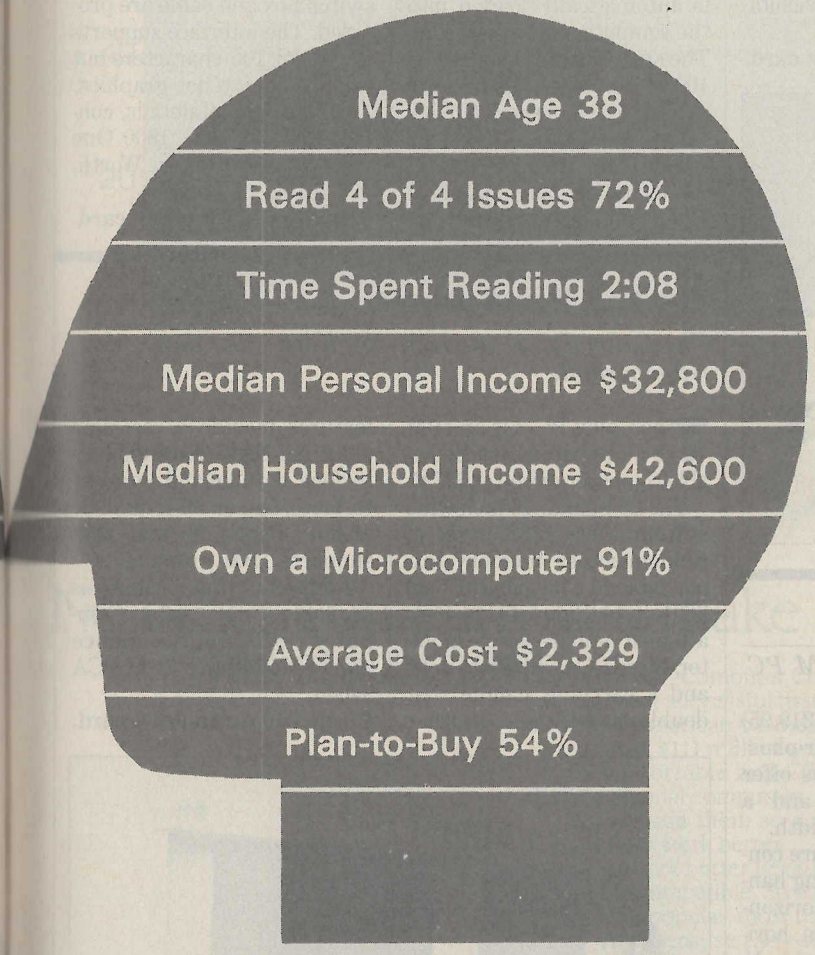


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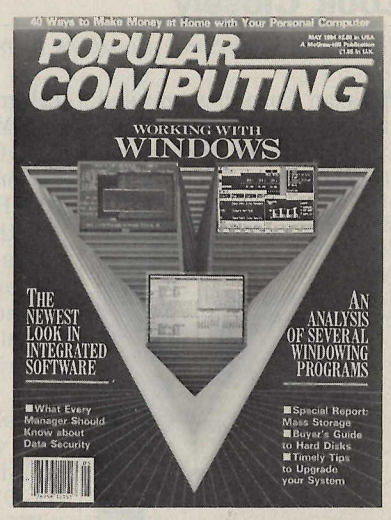
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## Interrogative Interface

*Card/?+G connects a parallel-based printer to your Commodore 64 or VIC-20*

Looking for a way to connect a printer to your Commodore 64 or VIC-20? Card/?+G works with a wide array of parallel-based printers.

The device, which connects without modification to either computer or printer, supports the complete Commodore character set, including graphics characters, inverse characters, and inverse graphics characters. Card/?+G offers switch or software control between Commodore ASCII and standard ASCII character sets. Compatible printers include the Epson MX, RX, and FX series, Star Gemini 10X and Delta 10, Prowriter, and Okidata models 82, 83, 84, 92, 93, and 94, and the Gorilla Banana. Card/?+G, with cable, sells for $89.95. Additional details are available from Cardco Inc., 313 Mathewson, Wichita, KS 67214.

**Circle 207 on inquiry card.**

## Look Closely

*Taxan monochrome monitors to match your IBM PC*

Taxan Corp. has unveiled a pair of IBM Personal Computer-compatible monochrome monitors. The Model 121 green-phosphor ($219.95) and Model 122 amber-phosphor ($229.95) displays offer flicker-free viewing and a 20-MHz video bandwidth.

Both units also feature convenient built-in carrying handles and controls for horizontal and vertical position, horizontal and vertical hold, V-linearity, contrast, and brightness. An optional tilt and swivel base ($49.95) permits easy viewing and includes a built-in liquid crystal display (LCD) clock.

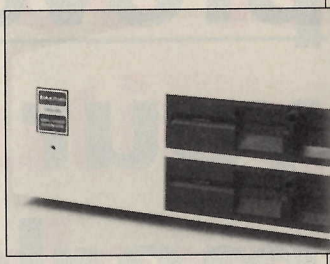
Write to Taxan Corp., 18005 Cortney Court, City of Industry, CA 91748.

**Circle 208 on inquiry card.**

## Expanding the Model 100

*The TRS-80 Disk/Video Interface expands the Model 100's mass storage and display capabilities*

The TRS-80 Disk/Video Interface transforms the Radio Shack TRS-80 Model 100 portable computer into a full-featured desktop system.



Priced at $799, the interface includes a 184K-byte 5¼-inch floppy-disk drive, a video interface, and an RF television converter. An optional second disk drive is priced at $239.95. The unit connects to the Model 100 via its 40-pin expansion port. The Disk/Video Interface's operating system is automatically loaded into the computer upon power-up. The system requires a Model 100 with at least 16K bytes of random-access memory (RAM).

The unit's video interface enables the Model 100 to be connected to any standard video monitor. Users can choose either a 40- or 80-column display. The RF converter allows the Model 100 to generate a 40-column display on any television. A switch box and cable are provided. The interface supports all Model 100 characters but cannot display dot graphics.

For additional details, contact Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102 .

**Circle 209 on inquiry card.**

## On the Road Again

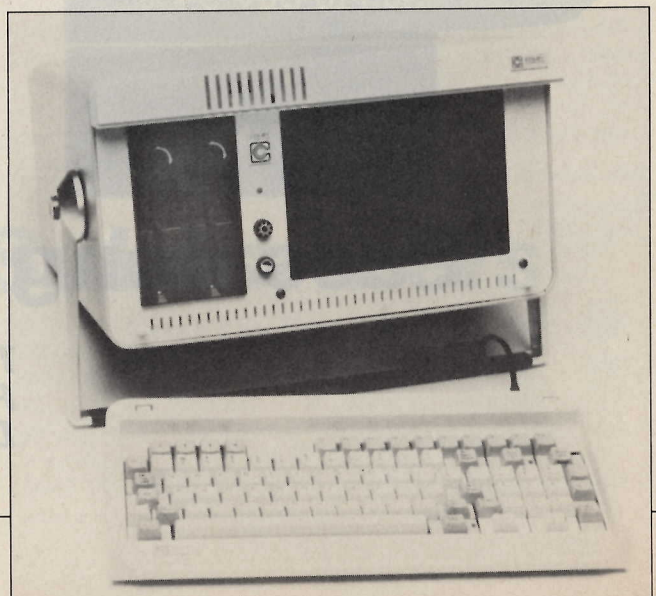
*The Colby PC-3—an IBM PC work-alike that's also transportable*

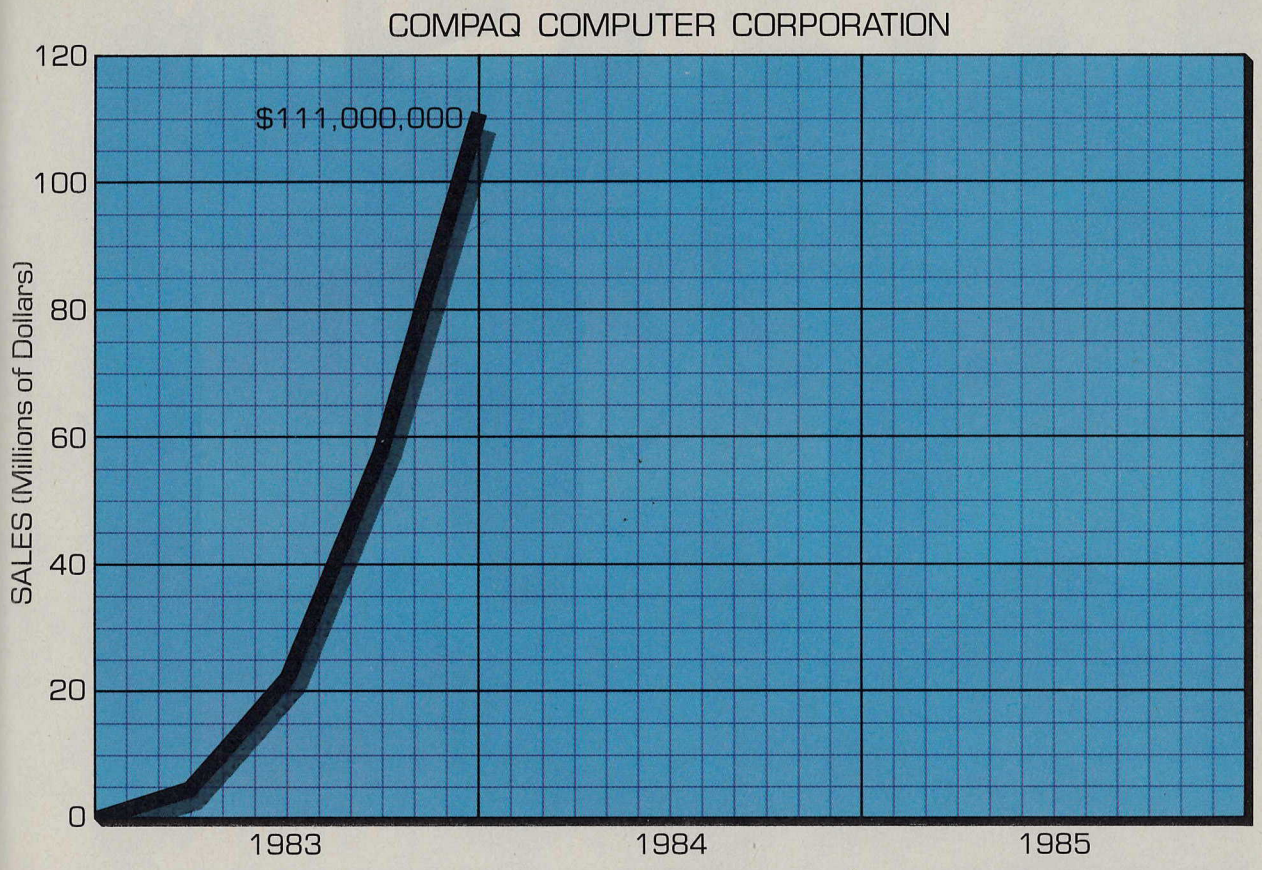
The Colby PC-3 is an IBM PC-compatible transportable computer priced at $2795.

The 26-pound, 16-inch-wide system offers 128K bytes of random-access memory (expandable to 1 megabyte), dual 360K-byte floppy-disk drives, a 9-inch amber-screen monitor, three PC-compatible slots, and a carrying handle that doubles as a tilt stand. Other features include a real-time clock, an SASI hard-disk interface, parallel and serial interfaces, and an 80-column by 25-line display format that supports IBM graphics.

Additional information is available from Colby Computer, 849 Independence Ave., Mountain View, CA 94043.

**Circle 210 on inquiry card.**



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# In the flash of one second, Delta-10 can print the alphabet six times.

At 160 cps, 100% duty cycle, Delta-10 is built for speed. It's the dot matrix printer that quickly strikes up an intense working relationship with your computer.

There's no nonsense. Delta-10 performs with serial and parallel interfaces as standard. The 8K buffer gives Delta-10 the power to instantaneously store and print data as it frees your computer to continue its job. Turn Delta on and it can print three crisp copies simultaneously at the continuous speed of 160 cps.

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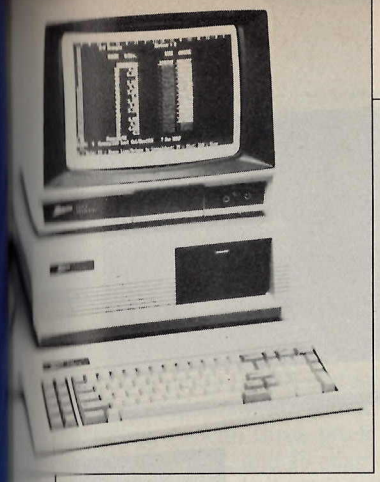


## Along for the Ride

*Zenith's desktop and portable IBM work-alikes*

Zenith jumps aboard the IBM-compatible bandwagon with a line of three desktop and two transportable computers. Each offers an 8088 microprocessor and 128K bytes of random-access memory (expandable to 640K bytes).

The Z-100 desktop units each include an IBM-compatible expansion bus, two RS-232C serial interfaces, a parallel port, red-green-blue (RGB) color and monochrome outputs, and a detached keyboard. A system with one 5¼-inch floppy-disk drive retails for $2699; a dual-disk version is priced at $3099; a system containing a 10-megabyte hard-disk drive and a floppy-disk drive sells for $4799.

The transportable units, each of which weighs approximately 33 pounds, offer the same features as the desktop systems plus a 9-inch amber display screen and a built-in carrying handle. A single-disk version sells for $2799; a two-disk configuration is $3199.

For complete details, contact Zenith Data Systems Corp., 1000 Milwaukee Ave., Glenview, IL 60025.
**Circle 211 on inquiry card.**

## Optimal Spooler

*Printer Optimizer—a printer spooler*

Applied Creative Technology has introduced Printer Optimizer, a printer spooler that features a Z80 microprocessor and 64K bytes of memory (expandable to 256K bytes).

When connected between a computer and one or more printers, the unit provides a total separation of printing and computing functions. Users can control form stops, job orders and priorities, and font sizes and styles. The spooler can also be programmed to translate text files from one language to another, to create graphics on dot-matrix or daisy-wheel printers, and to generate an unlimited number of document copies.

Printer Optimizer can be used with a modem, enabling it to function as a stand-alone receiver or transmitter. The unit is housed in a cabinet that complements the IBM Personal Computer. Its retail price is $499.

Additional details are available from Applied Creative Technology Inc., 2156 West Northwest Hwy., C-303, Dallas, TX 75220.
**Circle 212 on inquiry card.**

## Apple to Mainframe Connection

*Hook up your Apple to an IBM mainframe*

Apple Computer is offering Appleline, a coaxial attachment unit that lets Apple personal computers tie into IBM and IBM-compatible mainframe network systems.

Appleline, which works with Macintosh, Lisa, and Apple III systems, connects between a personal computer's RS-232C interface and any IBM 3270 cluster controller. The system supports IBM 3278 terminal emulation as well as the usual personal computer functions. The unit has a usable range of 5000 feet and requires only minimal changes to its host computer's software. Connecting a modem to Appleline enables users to access their companies' mainframe computers from remote locations.

Appleline is priced at $1295 and requires the use of a Lisa-terminal, Macterminal, or Access 3270 software package. More details are available from Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014.
**Circle 213 on inquiry card.**

## Voice of Authority

*Speech recognition for the IBM PC*

Microphonics' Oto-I speech recognition system lets IBM Personal Computer and PC-compatible users convert MS-DOS-based programs to accept speech input.

A plug-in card that inserts into any PC slot, the system provides a transparent interface that allows voice input to be used interactively with a keyboard or other data-entry device. Features include a better than 98 percent recognition accuracy, a 128-word internal vocabulary (expandable to 512 words), 16K bytes of random-access memory (expandable to 64K bytes), control of up to 32 syntax subgroups, automatic gain compensation, and background-noise filtering. The system, priced at $795, is bundled with three software packages that provide user training and a wide range of games and utilities.

Write to Microphonics Technology Corp., POB 7411, Federal Way, WA 98003.
**Circle 214 on inquiry card.**

← Circle 65 on inquiry card.

## Also Known As . . .

*Aka Computers enters the IBM-PC clone zone*

Aka Computers Inc. has unveiled the Aka Personal Computer, an IBM PC workalike that includes an 8088 microprocessor, 128K bytes of random-access memory, and two half-height floppy-disk drives.

Priced at $3295, the Aka PC system also offers either a monochrome or a color display card, a detachable keyboard, five expansion slots (expandable to nine), two serial interfaces, a parallel printer port, and an MS-DOS operating system. The computer includes a 100-watt power supply and a fan and provides room for up to four internal floppy drives. A hard-disk-based version—the Aka Personal Computer Plus—features a 10-megabyte hard-disk system plus two half-height floppy drives. The $4795 computer also offers space for an additional hard-disk unit.

For complete details, contact Aka Computers Inc., POB 36247, Charlotte, NC 28236.

**Circle 215 on inquiry card.**

## Apple Talk

*Introvoice II lets your vocal cords give your fingers a rest*

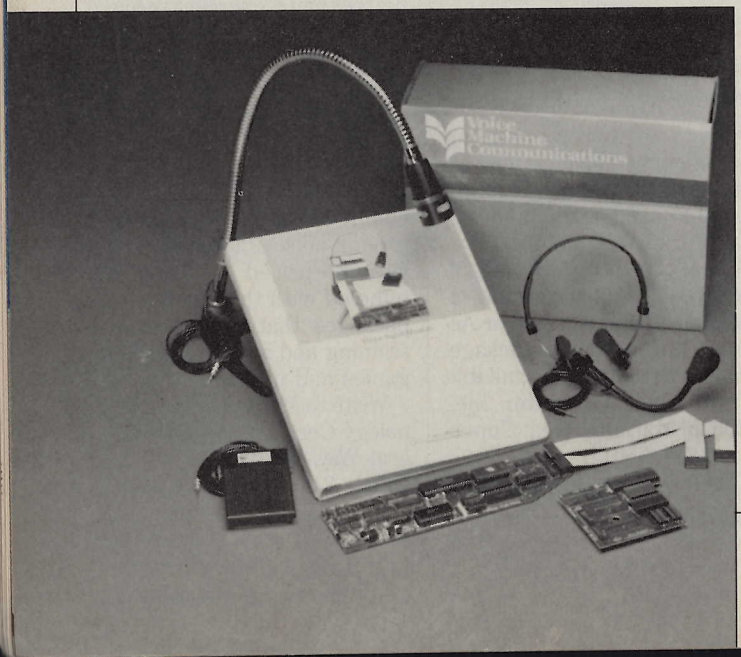
Introvoice II is a speech input device designed for the Apple II Plus and IIe. The unit allows users to control any Apple-compatible software package through voice commands.

Consisting of a plug-in card, support software, and microphone, Introvoice II boasts a recognition accuracy of about 98 percent for a vocabulary of up to 160 words. The system permits the easy definition of syntax structures and allows the control of both foreground and background programs.

The Introvoice II card contains a 16-channel audio spectrum analyzer, 16K bytes of random-access memory, and 8K bytes of read-only memory. Other features include voice-controlled repeat, correction, and on/off functions. The unit is priced at $920 for the Apple II Plus, $995 for the Apple IIe.

For more detailed information, write to Voice Machine Communications Inc., 1000 South Grand Ave., Santa Ana, CA 92705.

**Circle 216 on inquiry card.**



## Purr-fect Computer

*The Wildcat—an Apple and CP/M work-alike*

Wildcat is an Apple- and CP/M 2.2-compatible computer that offers Z80 and 6502 microprocessors, 64K bytes of random-access memory (RAM), and a wide variety of standard features.

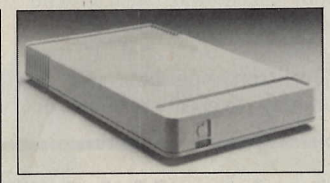
Priced at $1099, the unit includes a detached keyboard with numeric keypad and 24 function keys, a 5¼-inch floppy-disk drive, an uppercase and lowercase display, and serial and parallel interfaces. The computer also offers low- and high-resolution color graphics, two game I/O ports, an internal speaker, and monochrome and composite color video outputs. An optional carrying case and power converters allow use in remote settings.

For more details, contact Wholesale Technology Inc., 1530 South Sinclair, Anaheim, CA 92806.

**Circle 217 on inquiry card.**

## Apple Modems

*Modems for any variety of Apple*



Apple Computer has introduced a pair of modems for its Apple II, Apple III, Macintosh, and Lisa computers.

The Apple Modem 300 and Apple Modem 1200 are command-compatible with the Hayes Smartmodems and work with a variety of communications software packages, including ASCII Express, Data Capture, Access III, Visiterm, Z-Term, and Transcend 1-2-3. Both units feature auto-answer and auto-dial functions. Apple Modem 300 operates at 300 and 110 baud; Apple Modem 1200 offers speeds of 1200 and 300 baud. Both units plug into a standard RS-232C interface.

Apple Modem 300 is priced at $225 ($299 with Apple II serial interface card and terminal program). Apple Modem 1200 costs $495 ($570 with interface card and program). More details are available from Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014.

**Circle 218 on inquiry card.**

## Doing Double Duty

*Electronic Compact 2—a typewriter/printer*

Olympia's Electronic Compact 2 is a desktop typewriter that doubles as a computer printer.

Standard features include a 46-key keyboard with light-emitting diode (LED) status indicators, a daisy-wheel printing system, three pitch settings (10, 12, and 15 characters per inch), half-spacing, and forward and reverse indexing. The unit also offers a 46-character correction buffer with automatic relocation, electronic margin and tab setting, and a diagnostic mode.

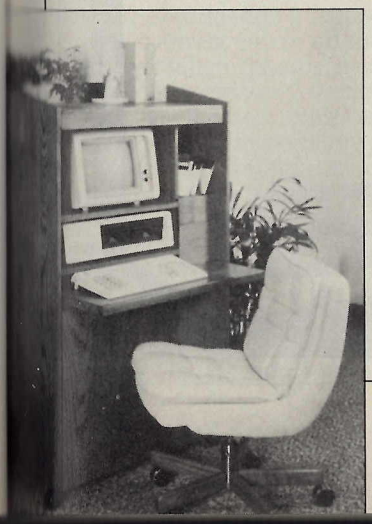
An optional expansion module (required for printer operation) features parallel and RS-232C interfaces, a 2K-byte memory buffer, a clear memory key, and a copy key that automatically prints the contents of the buffer as often as required. The Electronic Compact 2 has a print speed of 14 characters per second and retails for $599. The expansion module is $149.

Complete details are available from Olympia USA Inc., Box 22, Somerville, NJ 08876.
**Circle 219 on inquiry card.**

## Not for Junior Only

*Daisy Desk Jr—a home for your computer and peripherals*

Daisy Desk Jr., from Daisy-Net International, provides an elegant and safe home for your computer. Designed with two fold-down access panels, the unit offers room for a computer and keyboard, printer, video display, modem, disk drives, and supplies. Features include a cooling fan, a lock, and adjustable shelves.



Daisy Desk Jr. is constructed of solid oak and measures 36 by 24 by 55 inches. It's available for $740 in a choice of three shades.

For more details, write Daisy-Net International Inc., POB 1152, Northbrook, IL 60062.
**Circle 220 on inquiry card.**

## LAN Computer

*A low-cost network for the IBM Personal Computer*

Chase Technologies is offering the Chase DL, a computer designed for local area network application. The system has a keyboard, video monitor, nine expansion slots, and Orchid Technology's PCnet Plus multifunction interface board with 128K bytes of random-access memory.

The Chase DL ($2395) is compatible with all computers, peripherals, and software packages that support the DOS 2.0 or 2.1 PCnet local area network. Floppy-disk drives are not required on either the Chase DL or network workstations.

More information is available from Chase Technologies Inc., 375 Sylvan Ave., Englewood Cliffs, NJ 07632.
**Circle 221 on inquiry card.**

## Robie the Transportable

*A compact computer with plenty of mass storage*

Kaypro has introduced Robie, the latest addition to the company's line of transportable computers.

Priced at $2295, the unit offers two 5¼-inch floppy disk drives, which provide a total of 5.2 megabytes of storage capacity. Other features include a Z80 microprocessor, 64K bytes of random-access memory, a built-in 300-baud modem, a real-time clock/calendar, and parallel and serial interfaces. The compact system is bundled with programs for an electronic spreadsheet, word processing, a spelling checker, and database management.

For complete details, write Kaypro Corp., POB N, Del Mar, CA 92014.
**Circle 222 on inquiry card.**

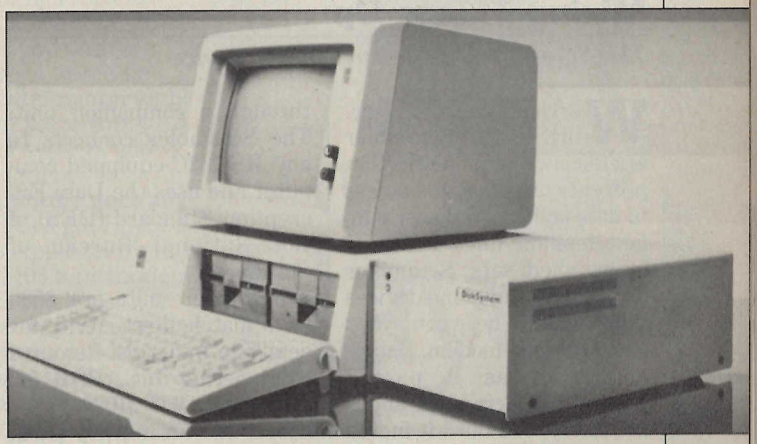
## Hard (Disk) Facts

*The Interface Inc hard-disk system*

The I² Disksystem is a 5¼-inch hard-disk drive for the IBM Personal Computer.

The unit, which offers 33.3 megabytes of unformatted storage capacity, records data at a density of 640 tracks per inch and features an average access time of 40 milliseconds. The 5¾- by 8¼- by 15¼-inch drive comes in its own cabinet and is shipped with power supply, cables, and connectors. It sells for $2795.

More details are available from Interface Inc, 7630 Alabama Ave., Canoga Park, CA 91304.
**Circle 223 on inquiry card.**



## More Memory

*Microram 64K puts 64K bytes of random-access memory into the Atari 600XL*

Microbits Peripheral Products has unveiled Microram 64K, a plug-in board that adds 64K bytes of random-access memory (RAM) to the Atari 600XL.

The additional memory provides room for a disk-operating system and enables the computer to run Atari 800XL-compatible software. It also supplies ample workspace for such memory-intensive programs as Visicalc and Atari Writer. The board, which is priced at $149.95, plugs into the computer's expansion bus. No internal modifications are required.

Additional details are available from Microbits Peripheral Products, 225 West Third St., Albany, OR 97321.

**Circle 224 on inquiry card.**

## Mixing Things Up

*The Scrambler, a file encryption device*

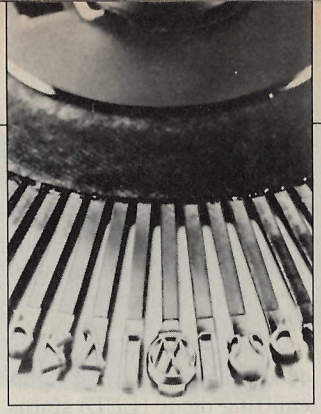
Worried about data security? The Scrambler is a file encryption device that prevents unauthorized access to data transmitted over public telephone lines. Provided in matched sets, Scrambler units are stand-alone devices that install between your computer and modem. Data is encrypted as it passes through the Scrambler and is not decrypted until it moves through a companion unit. The Scrambler connects to any RS-232C-equipped computer and uses the Data Encryption Standard (DES) of the National Bureau of Standards.

Scrambler units are $590 for a matched set. Write for details to Industrial Resource Engineering Inc., POB 57, Timonium, MD 21093.

**Circle 225 on inquiry card.**

## Print Wheel Pizzazz

*Add custom designs to your printer's print wheel*



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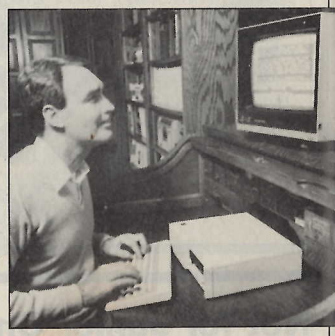

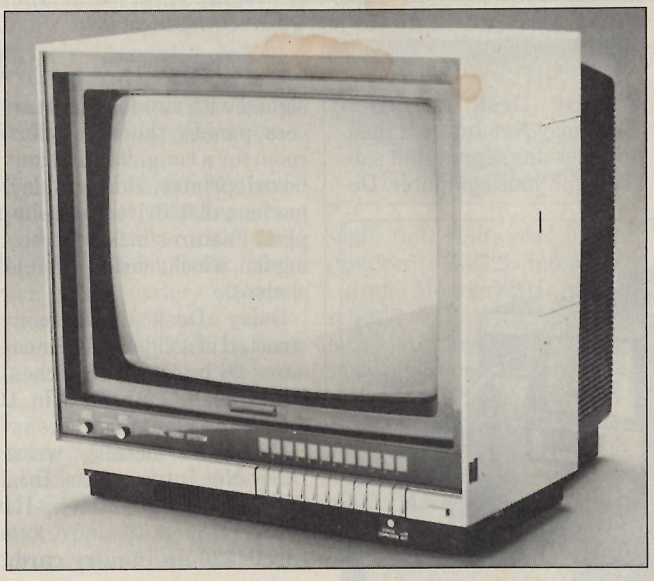

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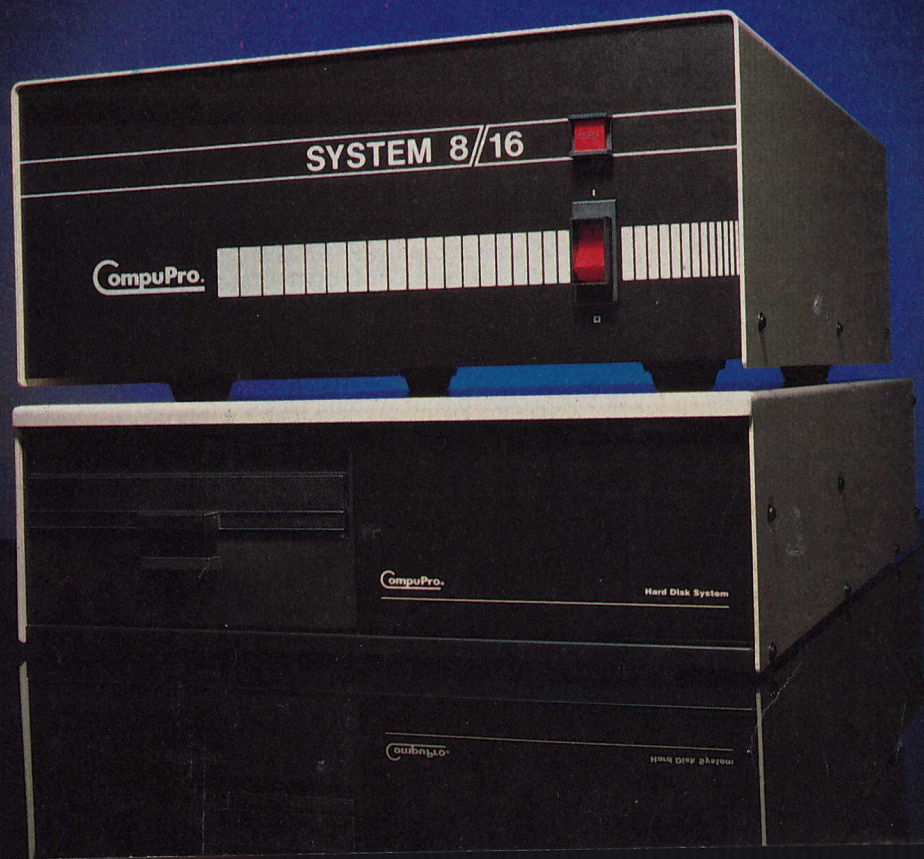

# Electric Pencil's Rise and Fall

*Running a software business was not Michael Shrayer's cup of tea*

by A. Richard Immel

Ask someone to name a word-processing program for a personal computer and more than likely the first name that comes up will be Wordstar. If you press hard enough, you'll get a bunch more, names like Applewriter, Easy Writer, and Superwriter. Eight years ago, however, that same question would have produced but a single response: Electric Pencil.

That's because eight years ago Electric Pencil, or "the Pencil," as its hard-core fans called it, was the *only* word processor you could get. There was nothing else. Wordstar and all of the other Easy/Perfect/Super/Whatnot Writers weren't yet even glints in their creators' eyes.

Pencil was king. Those who used it still remember it with nostalgia, as car buffs of certain generations still remember models like the '51 Olds 88 and the '67 Chevy Camaro. Even that illustrious warehouse of Americana, the Smithsonian Institution, is interested in adding the Pencil to its history of microcomputing collection. Dr. Uta Merzbach, the Smithsonian's curator of mathematics, regards Pencil as "certainly one of the significant programs for micros."

Pencil was good. It was easy to learn and it was easy to use and it was very, very fast. It was also easy on the matchbox-sized memories that existed in those early micros, the Altairs and Sols and all of the other S-100-type computers that blazed the path that Apple and Radio Shack took to the micro revolution. Pencil hit its stride in the late 1970s, running on the TRS-80 computers that got the mass micro market into gear.

And then, almost before it started, it was all over; the Pencil quit. What happened?

The answer is in the story of the rise and fall of Michael Shrayer. Shrayer is the ex-filmmaker turned computerist who wrote Pencil for his own use, rode it to the top, and then at the moment it could have dominated the industry, mysteriously abandoned it in the manner the ancient Mayans abandoned their hard-built cities and disappeared forever.

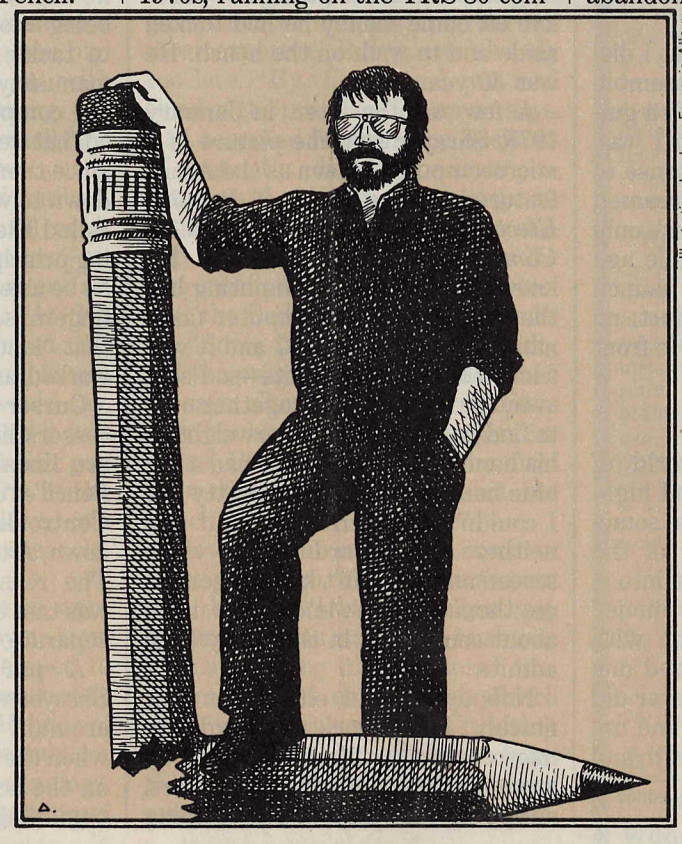

Illustration by Jean Francois Allaux

Shrayer didn't disappear forever, of course, and I set out to find him and find out why this man who would have been king did what he did. I had heard he was living in some kind of self-imposed exile somewhere in Southern California; eventually I made contact through a go-between, a software publisher and friend of Shrayer's named Harvard Pennington.

Pennington is more than a friend. He is a colleague, a confidant, a booster, and a moral supporter. He and Shrayer are kindred spirits, both having come out of the film business. They met because of Pencil. "I've always been a real fan of Electric Pencil,"

Pennington says. "I mean a *real* fan." In fact he's such a fan of Pencil he's revived it by putting together a version for the IBM PC family of computers. He's selling it under Shrayer's imprimatur and with his philosophical blessing but without the benefit of his coding (Pennington hired outside programmers to convert Pencil, under Shrayer's supervision, to MS-DOS machines).

Pennington arranged a meeting at his small software publishing company, IJG Corp., in Upland, California, a freeway city east of Pasadena on the route that connects Los Angeles with Palm Springs. After all the rigamarole of setting up the interview I guess I expected Shrayer to turn out to be some melancholy sort of Hamlet character filled with angst and remorse and searching his soul at the drop of a question. My first impression was just that. He looked like some kind of prince of darkness, dressed all in black: a black Carrerra windbreaker, a shiny black shirt, charcoal slacks, and black loafers. His longish hair was coal-black and he wore a matching beard and moustache.

It was with great relief that I discovered the book did not resemble the cover. I shook hands with a guy who was more relaxed than I was, a guy with a self-mocking sense of humor and an accent that screamed New York! New York! Shrayer's only apparent concession to middle age (he turned 50 in July) is a paunch around his middle, the product, no doubt, of too much inactivity in front of a computer keyboard.

### Not for the Money

In today's sales-hype world of millionaire programmers and high-powered ad campaigns it's sometimes forgotten that many of the pioneers of the business got into it as Shrayer did: not for the money but because of a fascination with computing. Some later traded one for the other, but Shrayer never did that. "This may seem trite and unreal," he says, "but it's the truth and you can take it for what it's worth: money has never really been a motivation for me. I need something else."

It was that "something else" that got him into computing as a second career, following 20 years as a New York filmmaker. He remembers vividly his departure from the Big Apple. He was in the midst of producing a Pepsi-Cola commercial, the one where the bottle cap dances to the tune of the Pepsi jingle. "Suddenly I just pulled myself up into the far corner of the room, you know, mentally, and looked down at what was going on." There were more clients than technical people and everybody wanted to ride on the camera dolly and help out with the shot. "I said, 'What am I doing here? It's insane.' "

It was Shrayer's last work in film. He tore up his union cards, walked away from a couple of union pension funds (in those days you couldn't take money out of a pension fund if you quit working before normal retirement age), and moved to Los Angeles. His immediate goal was to live off some money he had tucked aside and to walk on the beach. He was 40 years old.

A few months later, in January 1975, Shrayer saw the picture of a microcomputer known as the Altair featured on the cover of *Popular Electronics* magazine (now called *Computing and Electronics*). He knew nothing about computing but the idea of a home computer fascinated him. "It was $397 and it was a kit—I loved building kits—so I sent away for it." He got it together only to find he had a $397 paperweight on his hands. "I discovered I had a big blue box that was rather pretty but I couldn't do much with it." It had neither a keyboard nor a video screen and he didn't know where to get them. "I didn't know very much about computers in those days," he admits.

Nobody else did, either, but very quickly a network of hard-core microcomputer freaks sprang up around these Altair computers, swapping information and helping each other out. The group eventually grew to several thousand and became the Southern California Computer Club. Shrayer taught himself how to program his Altair in machine language (that's all there was then) by flipping toggle switches on the front panel of the machine. Eventually he built a terminal by wiring a keyboard to his Sony TV set, but "of course there was no software, really, and the first thing that had to be done was to write some software to write software with."

Starting with a piece of public-domain software that was barely acceptable for this purpose, Shrayer reworked it and built on it and found there was a market there. He started selling it for $30 a copy. Shrayer took a liking to the innards of computers and put together an even more elaborate operating system, one that was so complicated it needed a big manual to explain how it worked.

### Writing His Own Editor

The immediate problem was how he was to write such a manual. Not being a touch-typist, he wasn't about to tackle the job on his "clunky" manual typewriter. Why not do it on the computer?

That required a text editor, and since there weren't any, Shrayer sat down to write one. It would later be called Electric Pencil. One underlying principle of the program was that he be able to get around in it with two fingers, so he wrote it in a manner that "kind of flowed with the way I worked and was easy to use."

Cursor movements in word processors like Wordstar, for example, are lineal descendents of Electric Pencil's "diamond" layout (press the Control key and W to go up, Z to go down, A to go left, and S to go right). The reason for this arrangement was that early keyboards didn't have separate cursor-moving keys.

A particular fascination for Shrayer was the idea of word "wrap-around," which is what happens when the last full word that won't fit on the screen line is placed at the beginning of the next line. Shrayer

A. Richard Immel is a contributing editor of *Popular Computing*.

says he had never seen such a manipulation before he wrote his. "When I did that for the first time I just sat there in awe," he says. "I said, 'My God, this is wonderful, look at that!' " Shrayer's programming days were grueling, but it was by choice. "I put in 16 to 20 hours a day just sitting at the keyboard until I was physically exhausted. That's the way you learn."

Shrayer's philosophy of programming is simple: "If you can say it, you can write it. That's the thing I just love about computers."

What he didn't enjoy was business. Pencil was completed in early 1976, which is when the short, unhappy life of Michael Shrayer, businessman, commenced. It began in a sneaky way, with phone calls from friends. "People got wind of the fact that I was writing some sort of fancy text editor," he says. "When I completed it, the interest was so high and the demand so huge—I mean everybody was jumping all over me for it—I started to sell it.

"I really didn't have much hope or expectations for it because I figured, well, it'll be out on the market for a few months and somebody, the bigger companies, will come out with their own." He was dead wrong. "As it turned out, we had virtually no competition for almost two years, which completely shocked me."

The monopoly, short-lived as it was, didn't do much for Shrayer's attitude, however. "We almost got arrogant about it," he says. "At five o'clock on the dot I turned the phones off. The phone would ring a minute after five, and I would say, 'Ha, ha, you missed us!' And it was terrific because I knew that that guy was going to call first thing in the morning; he had no place else to call. If he wanted a word processor, he had to have my product."

The first versions of Pencil were "very, very crude," Shrayer says, mainly because it was designed to work only with his particular computer setup. It displayed 16 lines of 64 characters each. Within months, however, Processor Technology came out with its Sol computer and Shrayer was deluged with requests from Sol dealers to adapt Pencil to the Sol. It was to be the first of many such requests to make adaptations.

### Porting His Program

As the microcomputer market gathered steam, Shrayer was put upon to make versions for each new machine that hit dealer shelves. Most he agreed to do, but there were some exceptions (one of the latter was Apple Computer, which wanted a version for the Apple II. Shrayer turned them down because he hated working with the 6502 microprocessor in the Apple).

Shrayer hired freelance programmers to help and ended up eventually writing 78 versions for half a dozen different operating systems and various machine and printer configurations (all based on the 8080/Z80 family of microprocessors). Each one was another nail in Pencil's coffin. Curiously, it was the last two versions—written for the popular Radio Shack TRS-80 computers—that were the most successful and gave Shrayer and his program the most exposure. But it was already too late. "By that time I was real tired of the program," Shrayer says.

"I resented being in the business of constantly adapting the same program and I couldn't wait to stop. As each version came out I'd keep saying, 'This is the last one, this is the last one.' " And then there was a last one: the Radio Shack TRS-80 Model II. "Some friends of mine actually put the program onto that machine," he says. Shrayer's last version was also his biggest money maker, because Radio Shack was the first mass-market micro on which the Pencil had run.

Shrayer shut down his business three years ago. "All the fun was out of it," he says. "I was basically a businessman, I was running a business, I wasn't having fun anymore."

I mentioned earlier that Pencil was good. It was good, but it wasn't perfect. While it had fewer bugs than most commercial software products of its time, a common com-


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plaint was that fast typists sometimes "lost" characters typed at the very end of a line while the computer was calculating the wrap-around of the last word on the line. Much of Shrayer's reputation for arrogance and a bad attitude came from the way he dealt with these complaints. In a word, he didn't.

"First of all, the problem never really showed up until we put the program on the Radio Shack machines," Shrayer explains. There were a few isolated cases with other versions but these were solved by making some changes in the hardware to speed up the keyboard routines. Shrayer says he could have done a software patch, but "aesthetically it disturbed me, fixing it software-wise because essentially it was a hardware problem." Another factor was that Shrayer could never type fast enough to drop characters from his screen. "I tried to mock up the problem, you know; I'd sit there with two keys goings as fast as I could to see if I dropped any and I never actually saw the problem so it was a little unreal for me to fix it when I couldn't make it happen."

Shrayer's dilemma was subsequently solved by an outside programmer who put together a software patch (which Shrayer refers to derogatorily as a "kludge," the computer equivalent of a jury-rig). It was called "The Fix," and Shrayer bought it from him and resold it to his customers.

"I suppose it might be irresponsible, the whole concept of what I'm saying," Shrayer says, pondering it a moment and trying to think of his state of mind when all of this was happening. "I guess it is."

**Messy Litigation**

But in truth the real reason for his indifference to the lost characters had less to do with the distasteful aesthetics of software kludges than it did with monumental distraction. At that moment Shrayer was wrapped up in a lawsuit he had brought against Vector Graphic Inc. in a quarrel over the use of two versions of Electric Pencil on that company's microcomputers. It was a nasty, messy litigation, one of the first court cases involving microcomputer software. In the end Shrayer lost. It took three years out of his life and included a month-long trial, the death of one of the lawyers, and a malpractice suit against his own counsel. His friend Pennington says the outcome might have been different had the suit been based on copyright law instead of contract law, but it's over with and Shrayer has now put it all behind him.

"It was a black period in my life," Shrayer says. It was the last excuse he needed to shut down his business.

How much money did Michael Shrayer make on Electric Pencil? On that Shrayer plays coy, preferring instead to nurture what he calls the "myth" that he made a lot of money. "Most people felt I did much better than I've done," he says. "I've done well enough for me." He estimates he sold 10,000 copies of Pencil (although he thinks there may be 50,000 people using it; neither he nor Pennington believes in copy protection).

In today's market, of course, 10,000 copies is chicken feed. "I would say that Ashton-Tate takes in more in a week than I took in in an entire year when I was in business," Shrayer says. The retail price for Pencil started at $100 and eventually rose to $350 when the TRS-80 mass market kicked in, but it's hard to say how much Shrayer netted after distribution and other expenses. And of course he had legal expenses.

He looks at it as a "how rich is rich?" kind of question. "I suddenly found I had new problems and very little sympathy from my friends. My problems were where do I get some tax writeoffs to keep from giving it all to the government. It was very hard to tell these things to my friends because they said, 'Oh, I should have such problems,' which was true." Then, too, as time went on he increasingly saw how far removed he was becoming "from what my initial joy was, playing with my computer and having it as an extension of myself."

But now that joy is back. With his nightmares behind him Shrayer is a new person. He has a half dozen computers in his home now, spread out over four workstations (including the bedroom, where he works the most). They include an Atari, a Texas Instruments 99/4A, some Radio Shack models, a couple of lap portables, and the first two machines he owned—the Altair and a Sol, which he has completely refurbished. He's even had the insides chromed. Both of them are still "up and running and as good as anything around today." His "serious" work is now being done on a Radio Shack Model 16, which runs a Motorola 68000 microprocessor and uses Microsoft's Xenix (a version of Unix) operating sytstem and the C language, Shrayer's operating system/language of choice these days.

Shrayer says he's happy again. Part of his delight lies in his freedom from business. Does that mean there's no commercial future for him? Not necessarily. Shrayer believes in serendipity, the fortuitous but unpredictable conjunction of events. As a corollary, he also believes that excellence eventually will be rewarded. He's honed the two into a measure of cracker-barrel wisdom he dispenses to anyone who asks. It goes something like this:

Find something that you like to do and do it. If you like to do it, you'll do it well because it gives you pleasure and you're going to do it better than anybody who doesn't like doing it. Since you're doing a better job, sooner or later somebody is going to see you doing that and from somewhere, God knows where, they'll start throwing money at you.

It's dark when we finally leave Harvard Pennington's office and head outside. There are only a few cars left in the parking lot, one of them mine. Parked next to it is a flame-red 450 SL Mercedes-Benz coupe. "Whose car is that?" I ask Shrayer. "It's mine," he says. My eyebrows shoot up in a silent, not-too-shabby-for-a-guy-who's-out-of-work kind of look. "One of the last remnants of success," he says, smiling. "The Pencil's been good to me." □



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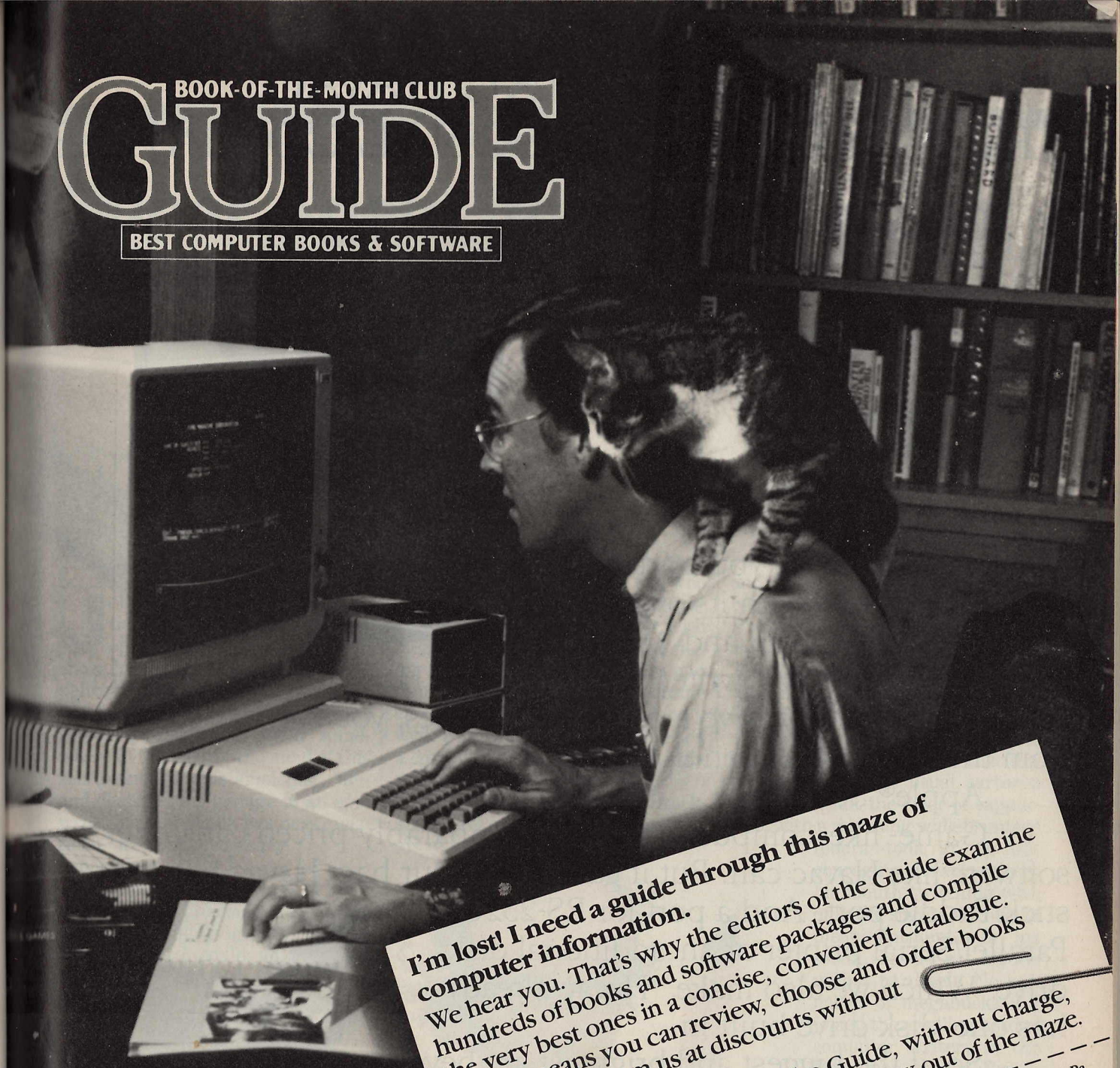

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*Rewriting the rules of the software publishing industry*

by Steven Levy

John Brockman had two questions for me as we met on the opening day of the Softcon show in New Orleans. Both were delivered in his classic deadpan style, a manner that is blunt but somehow distracted, as if somewhere in the back of the mind of this self-described epistemologist, life-and-death issues engage in an epic wrestling match and business questions are but necessary annoyances.

The first question was how did I want to conduct this roving interview of him. Before I could answer, he hit me with the second question: "Do you have an agent already?"

I told him I did. In fact, just the previous night, while looking over the 22-page list of clients represented by John Brockman Associates Inc. and the six-page printed folder announcing recent publications by these clients—clients ranging from *PC World* magazine to porn star Seka to software author Sat Tara Khalsa—I had experienced a startling revelation. There I was, paging through lists of an estimated three hundred computer books brokered by the man who virtually turned the computer book publishing industry around and who is bringing about even greater change in the software field with mega-deals that are luring the major New York book publishers into that media. And it soon became clear to me that I was the only writer in America who had finished a computer book who was not represented by John Brockman.

I confessed this thought to Brockman as we sat with his omnipresent entourage: his partner (in business and parenthood) Katinka Matson and his West Coast operatives Patricia Phelan (who's married to Brockman client Stewart Brand) and Angelica Theriot; they are among 16 people working in the Brockman operation (including a full-time lawyer). Brockman, a wispy 42-year-old in studious wire-rimmed glasses who that day was decked in his usual sartorial overkill—a suit the color of cappuccino, with a matching wide-brimmed fedora—took in my discouraging answer quietly, his mouth twitching with only the slightest frown of disappointment. To his credit, he did not hit me with a hard sell. No scenarios of megabucks if I joined the swelling herd of computer writers in the Brockman stable. Brockman has class: as he would later explain to me, "We're reasonably cordial and low-key, and all the same ruthless."

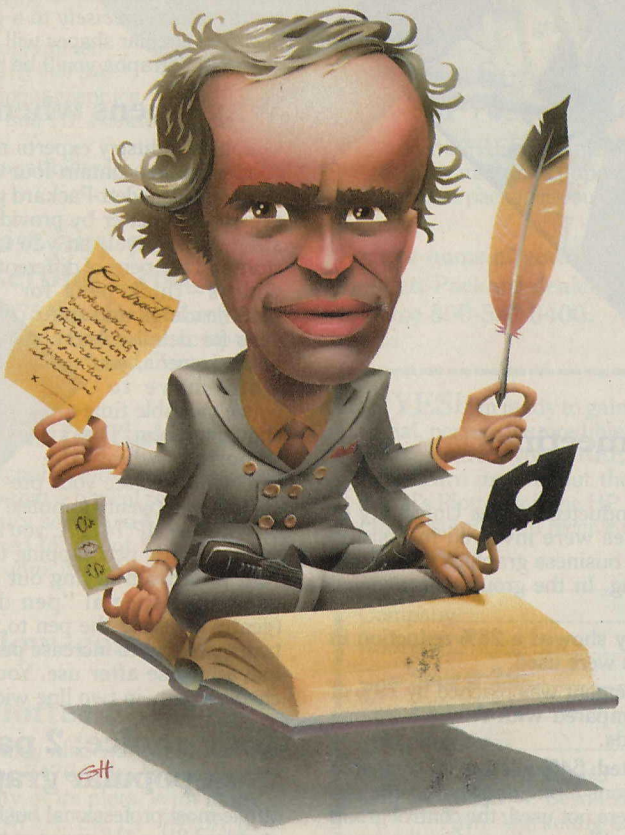


Illustration by Gary Hallgren

## Dual Personality

That contradictory statement is John Brockman in a nutshell. To hear people talking about him—as those involved in the business end of the software field so often do—you would think that Brockman is some sort of Swifty Lazar type, with a loud how-dee-do

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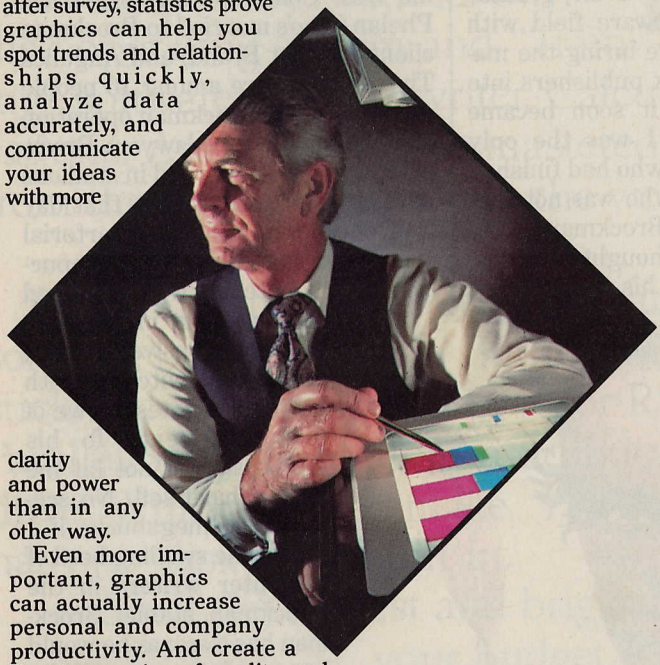

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and a handshake that would crack walnuts. How else could he have managed to become the undisputed single most powerful agent in the field? Instead, you get this mild-looking fellow who looks back to intellectual sixties radicalism as the previous high point in his existence. I set out to try to reconcile those competing strains. And what I found was yet another story of how, for some people, making bucks with computers in the eighties has become a viable replacement for making psychedelic waves in the sixties.

As Brockman and I set out on a two-hour ramble through the displays in the Superdome, I got his stock explanation of his efforts to singlehandedly change the software industry. "The mass market is in the home market," he said, as we threaded our way through the booths. "My mission is to *create* the home market for software." At that point we had reached a booth with some association with one of Brockman's clients—as I think half the Softcon booths had—and the booth had a chart on display listing the top software publishers in terms of 1983 revenue. Brockman, who has been on record as saying that all of these firms, from Microsoft to Broderbund, will be insignificant players within three years, looked at the chart and noted the piddling sums involved.

"That's why I don't deal with them," he said. "These companies have to sell 10 percent of themselves to do a million-dollar deal." Brockman, whose bread-and-butter is the 15 percent commission he collects on seven-figure software deals—his operation will pull in an estimated $3 million this year on computer book and software deals—has little patience for companies that insignificant. He prefers to deal with big conglomerates, big New York publishers like Simon and Schuster or Harper and Row, experienced publishers who are comfortable with gonzo advances unheard of previously in the software field. Until recently, these book companies had no interest in software. But that was before the then-obscure literary agent John Brockman stumbled upon the computer boom.

Brockman credits this historic union to his experience at the 1982 Comdex show. John Brockman at that point was a mildly successful literary agent specializing in serious nonfiction, much of it stuff from left field. John Lilly's dolphin book. Paul Krassner's Yippee tracts. Gregory Bateson on the Balinese character.

Brockman's own esoteric tomes, including *By the Late John Brockman* and *Afterwords*, were out of print. The books were cryptically written and loaded with references to such intellectual heavyweights as Ludwig Wittgenstein, Alfred North Whitehead, T. S. Eliot, Sören Kierkegaard, and Werner Heisenberg. In *Afterwords*, his masterwork, John Brockman declares that "Man is dead." Every page of that book seems to list a time-honored concept that, according to Brockman, does not exist. The last page of *Afterwords* reads, in its entirety, "Nobody knows, and you can't find out."

I don't mean to say that Brockman wasn't engaged in serious thought or that his work isn't provocative, even to those (like me) relatively unschooled in the cosmic ruminations of the top 40 modern philosophers. But, as stated on the back cover of a mysterious followup to his work, a book called *After Brockman* (Abyss Publications, 1974), "the public reception to (Brockman's) works remains, at best, a puzzled silence." *After Brockman*, an attempt to remedy that situation, was a symposium of various thinkers ruminating on Brockman's significance. The thinkers ranged from scientist John Lilly to Ira Einhorn, a former hippie cyberneticist who is currently on the lam after being accused of murdering his girlfriend and leaving her in a trunk in the closet of his apartment. *After Brockman* was compiled by a male nurse who was so taken with Brockman's works that he papered the walls of his room with pages from copies of *Afterwords*.

By the time *After Brockman* appeared, in 1974, John Brockman was 33. Brockman later elaborated on this point: 33 is a time for change, he began, because it was the age of Jesus at his death. Before Brockman got going on that too deeply, though, I asked if I could turn on my tape recorder, and he changed the subject to software. He seemed almost embarrassed to be talking philosophy at an interview about his business dealings—or he felt he didn't have time to expend on that discussion.

**It was at a Comdex show in 1982 that Brockman suddenly found the action he'd been looking for.**

### From Philosopher to Agent

Anyway, at 33, Brockman realized that he had accomplished pretty much what he had hoped to accomplish in his early life, what with writing books and surviving the sixties and acolytes who thought he was up there with René Descartes and Bertrand Russell. As he put it, "Once you've gone out to eat enough, it's just another restaurant." So the iconoclastic young philosopher turned into a budding literary agent.

But by 1982, all of it seemed old. Until Comdex. "Katinka and I had been wondering for years where the action was. Life during the sixties had been very exciting. The 1970s were very unexciting. Then we hit the floor of Comdex and saw this incredible energy. Here was a different kind of people—they *looked* different, they dressed different—but there was this buzz from these 80,000 people that was energizing and exciting."

Even before that Comdex, Brockman had been rethinking the whole computer industry. He recognized that, despite all the excitement,

Contributing editor Steven Levy's book, *Hackers: Wizards of the Computer Revolution*, will be published by Doubleday in the fall.

things were still mired in the hobbyist stage. The second wave of useful but difficult-to-master programs (Wordstar, dBASE II) was breaking on the beach. Brockman wanted no part of that wave. He was planning for the third wave.

"I had a realization that I'd rather influence the 25 million people who are going to be buying computers in the next few years. Obviously, all those people are going to be buying software. Software is an act of writing. I don't like to use the word literature because it confuses things, but it definitely is a literate act. It results in a copyrighted work. Our business for the last 10 years had been in dealing with copyrights for authors, the sale and license of specific rights in specific territories for specific works. But there was no such thing as a software agent."

**Brockman created the competitive climate in which Doubleday offered $1.3 million to become the publisher of Stewart Brand's "Whole Earth Software Catalog."**

### A Different Approach

It was a golden opportunity. His literary agent colleagues seemed to be missing this one, and other would-be agents who saw the potential rewards hadn't been able to convince big publishers to change the way they'd been doing business. Brockman knew he could do something different. It would mean he would have to change the focus of his business, which had been generally a continuation of the right-thinking ways of the sixties, largely representing respectable, serious books by significant authors who might otherwise have difficulty dealing with the tough publishing market, which often rewards trash rather than quality. John Brockman was willing to channel his energies and passion into that switch.

Setting up innumerable lunches with big publishers, Brockman tried to convince them that software would be *the* next big thing for them. When any magazine devoted a cover story to the computer industry, Brockman would make 20 copies and send them to publishers. Through an old client who'd done work for a computer magazine, he got his first client, a young firm named Bruce and James with a product called Wordvision, a simple word-processing program for the IBM PC. It took months, but his efforts bore fruit: he got Simon and Schuster to ink a pact with Bruce and James for its streamlined word-processing package, Wordvision. It would be sold in bookstores under the S&S imprint. After the publicity for that, potential clients began contacting Brockman.

Among those clients was a turbaned, white-suited Sat Tara Khalsa and his company Kriya Systems. Brockman got Simon and Schuster to buy the rights to Khalsa's Typing Tutor III program for a potential $5 million in royalties and a seven-figure advance. (Though Brockman does not divulge the exact amounts of his deals, he does affirm the accuracy of certain published estimates, and I'm using those here.)

Sat Tara Khalsa, a cheery red-bearded chap who wears his turban for religious reasons believes that no one else could have gotten him that kind of money. "I had been thinking of starting some kind of mass-market system myself but was having trouble getting started," he says. "I read about what John was doing and called him. He didn't return my call and I called him again. I'd read his stuff in the late sixties and thought we'd get along. Apparently he had me checked out and then immediately flew to Chicago" (where Khalsa hangs his turban). They did get along, and one day they rented the Oriental suite in New York's Carlyle Hotel, set up some computers with Typing Tutor to show the big book publishers, and to Khalsa's amazement, "they all came!" And Khalsa became a rich man.

### Changing the Rules

After a few of those multimillion-dollar software deals, Brockman turned to the computer book field. In early 1983, the usual author's advance for a computer how-to (word processing on your Apple, that kind of thing) book was around $5000. Then came Brockman. "What happened is that we figured out a way to do it. Rather than dealing with 50 separate authors, I went to *PC World*, *InfoWorld*, *Whole Earth Catalog*, *LIST* magazine. I convinced them to become packagers and sell a series of books."

What happened? *PC World* sold a series of 10 books for $600,000. *InfoWorld*, a series of six for a hundred grand apiece. *LIST* magazine got similar advances. And for Brockman's old friend Stewart Band and his *Whole Earth Software Catalog*, there was the best news yet. John Brockman circulated a 12-page proposal, planning for an auction of the rights. But before the auction could occur, Doubleday gave a "preemptive offer" for the unprecedented sum of $1.3 million. Brockman, of course, took his usual 15 percent for all of those package deals, including the one he says was easiest to do, the Whole Earth deal, which despite its advance is a tightly budgeted nonprofit project. Why take the full cut there? "We're not a nonprofit organization," says Brockman.

Why would publishers who had been previously paying $5000 a book suddenly change? "It was because of us," says John Brockman. The judgment is confirmed by *InfoWorld* columnist and Brockman's "technical adviser" John Dvorak, who says that "Brockman cornered the book market like the Arabs with the oil market and manipulated it for the biggest advances."

But $1.3 million?

Brockman: "A book is worth what someone wants to pay for it. It was

my job to create the conditions where books seem so valuable that the publishers *had* to get in on it. Which seemed to have happened. In the heat of an auction, or the expectation of an auction such as the Stewart Brand deal, you get the situation where winning is as important as acquiring the property. Remember, those publishers wanted to make a statement that they were getting in the business. What better way to make a statement?"

### Will It Backfire?

With all those megabuck statements being made, some New York publishers began to fret. How would all these books do when they hit the market in mid and late 1984? When I was strolling around Softcon with Brockman, being stopped every 20 feet by someone involved in some ongoing and Byzantine negotiation with him, his balloon was soaring, but in New York that past week some publishing people I'd spoken to had been wondering out loud whether Brockman's Scorched Earth policy of signing 300 high-priced, but generally uninnovative computer books in a year might not backfire. The books might cancel each other out, not make back their advances, and leave the publishers grumbling about this Brockman guy.

I mention this possibility to Brockman. He says it isn't his problem. "I'm not interested in the welfare of the publisher," he says. Later he elaborates: "I represent authors. My job is to do the best I can for my clients. That's what they're paying me for."

John Brockman stops our Softcon tour to talk to one of the owners of an educational software company that is not a client but is thinking about becoming one. It would be a classic Brockman arrangement—the client would be a company, not an individual author, with pretensions toward the home market. It would want Brockman to get a guarantee that the publisher would promote the company as a brand name in itself. And it would want one of those Brockmanesque advances. "We would need a hundred up front," the owner says. Meaning $100,000. "That's well within the realm," says Brockman.

John Brockman manages to move on before he sees the software in question. In fact, I'm noticing that he seems to consciously avoid looking at the products he sells. Almost as if he has no patience to look at software. "I don't go to shows to see cathode ray screens," he says. "I'm there to see who the players are and work with them." But even after the shows, he seldom looks at the software he pitches. "In the noncomputer book business we operate one way, and in the software business it's about money and deals. And that's what these people want. They don't


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want literary agents holding their hands in a semi-psychological relationship. They want someone to go out and be much more of a . . . mega-agent, so to speak."

### Dealing with Companies

It is quite a change from the way his agency used to run, where his clients were people he could relate to. Now, he deals with *companies*, who hire staffs to produce the software he sells; his clients in book deals are often packagers who hire the authors who actually write the books. The warm contact of a creative author and a caring agent is deemphasized, and Brockman knows that. "We're faced with a situation where a company wants to be a client and says, look here's our resources—cut the deal for half a million dollars and get your 15 percent. Do I want to do that, or do I want to work with someone out of college who looks interesting but has no track record, no ability to have a designer work with him, no one to do documentation . . . what would you do? There's only a limited number of hours."

**If Brockman's drive to deliver the software industry to major publishers succeeds, it could be the end for smaller companies trying to market creative products.**

Brockman likes Softcon. It's limited to software, and he can do business. This he does, constantly. I begin to see that his lack of physical and verbal pushiness is more than compensated by persistence and deft positioning. "Everybody I know is here," he says. "And no Texans selling disk drives." That night at the famous Arnaud's restaurant he hosts one of his notorious "celebrity" dinners. Over thirty people make the guest list of this one, which includes Stewart Brand, Sat Tara Khalsa, and Timothy Leary. Brockman hovers over the huge table, making sure that everyone is properly networked. Later he leads an expedition down Bourbon Street to hear the Preservation Hall Jazz Band. It is an odd pre-Mardi Gras procession of men in suits and women in evening dress, led by this solemn-faced pied piper of computer agentry. I'm a bit tipsy, but John Brockman is in perfect control. As we walk through the renowned French Quarter, with the accompaniment of saxophones blaring out of nowhere and the hustles of barkers urging us into strip joints, Brockman starts asking me what I think is the current state of the computer game field.

By day two of Softcon some are feeling the aftereffects of the revelry. Brockman, however, holds to a full schedule of meetings, chance and otherwise, through the show. The climax of the week's activities occurs during a panel discussion on the role of the software agent. The officially scheduled panel might well have been called "The Role of John Brockman," since the only participants are Brockman, Sat Tara Khalsa, and another Brockman client. Brockman is in fine form, telling the crowd that "we're not in business to make friends, we're in business to make money" and that "software is worth what people will pay for it."

When Sat Tara takes the mike to extol Brockman's fiduciary magic, he is especially enthusiastic in his praise of Brockman's strategy of trying to move the software action from the established, smaller software companies to the big New York publishers and conglomerates. "A $10 million company can't compete with Gulf & Western and its $3.9 *billion*," he croons. He predicts that the software industry, as a result of Brockman's efforts, will be just like the book industry, where if things aren't released by a major publisher, they might as well not be published at all.

I know that is part of Brockman's mass-market "mission," but I find it disturbing. A continual criticism of the book industry has been just that: by limiting "big" books to major publishers, the system in effect discourages innovative but risky works. A strength of the software industry to date has been those smaller companies that are able to release daring and creative products and still compete in the software free-for-all. I find it ironic that John Brockman, author of several esoteric and out-of-print books, is helping stamp out the ability of these small software companies to compete.

When I mention this to Brockman, he considers it for a minute and says, "You're absolutely right. And it's a very important issue to me because I was able to publish three very serious books of essays in the sixties. But if someone like me approached our agency today with something like that, I would have to say, 'Sorry, I can't help you.' "

### The Lucrative Center

Brockman does not deny that his current attempt to deliver the software industry to the major publishers, with his own agency neatly positioned in the lucrative center of the action, will hasten the same kind of confining situation in the software field. He prefers to speak of his more positive contributions, like his efforts to create a standard software author's contract.

The unfortunate side effects are perhaps necessary for the path John Brockman has chosen. In his own words, "I'm able to be an entrepreneur in a way I never could be as a literary agent." Who would have thought that entrepreneurship—an activity where success is measured in terms of dollar bills—would be the exciting tonic to revive people who thrived in the free-for-all sixties?

As Brockman says of the computer biz of the eighties, "This is all a wild west show. Everybody wants to make $20 million. The funny thing is that some of them are going to make it."

And when they do, John Brockman will get 15 percent. □

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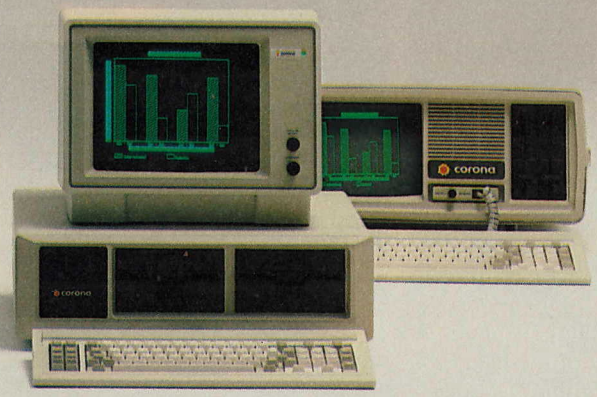


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# Rolling Your Own

*Why bother to program? For fun, profit, and an education*

by Jerry Pournelle

When my late friend Dan MacLean convinced me I ought to buy a microcomputer, it was supposed to be just for writing, although I did think it would be nice if it would do my taxes, too. Those were the days when you didn't buy a computer, you built it, from parts and components and kits. When MacLean, and Tony Pietsch who actually assembled the machine, delivered my computer, they brought a copy of the BASIC language.

"Whoa," said I. "Not me. You guys can do all the programming I'll ever want..."

Fortunately, my protests did no good. MacLean brushed my arguments aside and practically chained me to the keyboard until I had typed in and debugged a large BASIC program called the People's Data Base. This was long before you could buy database programs; Wayne Ratliff had yet to conceive Vulcan, much less turn it into dBASE II. The People's Data Base turned out to be useful, and indeed the handiest programs I have are built up from it; but the major value of getting it running was my increased understanding of my computer.

Those lessons have stayed with me. There's nothing quite like programming to teach "computer literacy." I soon learned that the machine wants *exact* instructions, and the difference between ":" and ";" or "I" and "l" is more important to a computer than to a human. We all know that "you know what I mean" makes no sense to a machine, but that elementary truth doesn't really come home until you examine for the fifth time a section of code that you know is right but which the machine stubbornly rejects.

There were practical benefits, too. Computers can accomplish dozens of small tasks if only you can teach them to do it. I found that out the first year I did my taxes with Ezekial, my friend who happened to be my first computer (a Z80; hence the name). Before my Form 1040 was in the mail I had written any number of small programs to collect and add up entries, save records, compute the amounts to fill in, and calculate the final tax. Later in the year I wrote programs to keep track of correspondence and make out the annual greeting card list. Other programs kept track of my trips and trip expenses.

Illustration by Anthony Russo

Of course that was all long ago, and now plenty of programs are commercially available. There are spreadsheets that know how to do your taxes, and mailing-list programs that integrate with your text editor. Database programs are getting smarter. Calendar programs are available. Now there's a rush to combine word processing, spreadsheets, a scheduler, and database into one master "integrated office

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program." Surely there's no necessity for a busy computer user to learn programming—and not much chance that the average user will write something better than he could buy. So why bother to program?

**The Joys of Hacking**

Well, for one thing, it can be fun. Not at first: I don't suppose I've ever experienced greater frustrations than when I first began learning to program. The joy of "I bet I can make it do that" gave way to "Why can't I make the damned thing behave?" After a while, though, something clicked. Gestalt psychologists would say I had an "Aha!" experience. Whatever happened, I lost the feeling that Ezekial was deliberately trying to drive me stark mad and saw him as a partner in tackling a problem I wanted to solve or game I wanted to play.

It's still fun. There's another value, too: I understand what other people's programs are doing. I may not be able to write a complex spreadsheet program, but I understand how it is done, which makes it a lot easier to use such programs effectively.

**Accounts Comprehensible**

The real value, though, is utility. A couple of years ago my column in *BYTE* described the accounting system I wrote for myself. Amazingly, I still use it; there are plenty of good accounting programs for sale, but I have yet to find one that works the way I want it to. Every accounting package I've ever seen appears to have been written either by a CPA or by a computer programmer. The CPAs assume I know a lot about accounting, and the programmers either don't know as much about the subject as I do or learned their accounting from someone who never read the texts I did. Either way, the programs are useless for me.

Although authors have odd accounting requirements, I'm sure mine are no more complex than those of many other professionals or small business people. I'm equally sure that the vast majority of people who keep elaborate books only do it because the IRS requires it—and that most of us don't know much about accounting and don't want to learn. We never got past Business Accounts 101, if we got that far—but the commercially available accounting programs assume we know what we're doing.

For example, BPI Systems sells an elaborate "Personal Accounting" program package for the IBM Personal Computer. I'm sure it's very complete. It comes with an enormous book that patiently explains how to turn on the computer, how to copy a disk, and so forth. It even tells me to "make certain that your printer power switch is turned on," to check cable hookups, and even to see that "your printer is correctly loaded with paper and the ribbon is good."

When it comes to explaining what we're *doing*, though, BPI tells us almost nothing. There is one index entry to "Journal," which consists of the following explanation: "What you enter at account prompts: You always enter both sides of the entry. When entering debits to an account, do not enter a minus sign. When entering credits to an account, you must enter each credit with a minus sign."

There are other discussions, equally clear. True, if you happen to know that debit and credit don't really mean "reduce" and "increase" and that in order to tell your accounts that you've just collected some money you *debit* cash (or checking-account balance), and when you spend money you credit that account, then it may make sense; but most of us don't know, don't want to know, and don't need to know any of that. Accounting esoterica can be interesting in the same way that the titles and obligations of Byzantine court officials can be interesting, but that knowlege should not be a requirement for making a living—or for using a computerized accounting program.

Other accounting programs are much the same; they assume I know so little about my computer that I won't (unless reminded) look to see that the printer is turned on and also that I know more about accounting than I have ever wanted to find out. Worse, I have, through sheer necessity, learned what a standard set of "books" looks like. Textbooks show me that Journals have a certain format and that within a Journal there are standard indentations for debit and credit entries. I have learned, although I frequently forget, that the "Fundamental Theorem of Accounting" is that "Proprietorship = Assets – Liabilities." Having learned all this, it is my fondest wish that I do not have to remember it. Isn't that what computers are for?

After all, the reason I bought a computer in the first place was so that I would never again have to retype a manuscript page. Prior to Ezekial I had become an authority on correction tape, Sno-Pake, vintage years of Liquid Paper, and the like; once I had a computer, I could throw all that junk into the trash. Surely my computer would do the same for keeping my books? Surely I would not have to remember the dreaded fundamentals of accounting?

It didn't work that way, of course. There's something about a computer—when programmers decide to write an accounting program, they can't give me something that does what I usually do. They have to improve on it. The result is that their printouts don't resemble the examples given in any accounting textbooks I ever saw. The Journals don't look like the ones in Myer's *Accounting for Non-Accountants*, the Ledgers don't look like those I studied in Accounting 101, and the reports don't look like anything I ever saw—including the output from other accounting programs.

If I hadn't known how to program, I'd have been stuck with what some other programmer liked. Instead, I wrote my own accounting system tailored to my needs and understanding. It produces books that look *exactly* like the examples in my

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Science fiction writer Jerry Pournelle, who joined the micro revolution seven years ago, is a contributing editor of *Popular Computing*.

texts, it does my depreciations and prints them the way I have always done them, it produces books that the IRS has never hesitated to accept, and whenever I think of something else I want it to do, I can add the new feature.

I don't suggest that everyone write his own accounting system, but it's a sure way to get one tailored to individual needs; and not just accounting systems. Greeting card lists, keeping track of stories for upcoming anthologies, word filters, indexing systems—all these are examples of programs I've written to do things for me the way I want them done.

Personal computers don't really get personal until you can tell them what you want to do, not merely do what some programmer decided you wanted.

**Get Rich...**

Another reason people learn to program is to make money. Wayne Ratliff made tens of millions of dollars from his dBASE II program. Wayne Holder has done extremely well with The Word Plus. Michael Shrayer cleaned up with Electric Pencil. One program can earn a fortune. You don't have to be a computer expert. Much of the best software was written by individuals, many with little previous computer experience.

All true, although most of the truly spectacular successes happened in the early days. Now, alas, we mostly hear about software development teams. When Richard Frank, Paul McQuestin, and their partners got started, they literally worked out of a garage, and the company name, Sorcim, was simply "micros" spelled backwards. (Aside: Soroc, which makes the IQ terminal line, is "Coors" spelled 'sideways'—the founders were stuck for a name and saw the tables littered with Coors cans...) For all their small beginnings, though, Sorcim is now a big outfit, with hundreds of employees and computers. At one time they had more than fifty people involved in their Supercalc project.

Software projects often begin with capitalization in the millions of dollars. For one thing, program development is expensive, and even if it weren't, advertising and marketing require enormous investments, or else no one will ever know the programs exist.

What chance has a single programmer against that kind of competition?

**If I hadn't known how to program, I'd have been stuck with what some other programmer liked. Instead I was able to write an accounting system tailored exactly to my own special needs.**

**The Odd Industry**

I wrote some of my first programs in the early days; plenty early enough to have gotten in on the great software booms. Like many another with a good program, I thought of making some money. Then I found out what that would require: I'd have to start my own company.

When I write a book, no one expects me to go to the North Woods, cut down a tree, pulp it, make paper, set type, print the book, sew the pages, and take the finished product to bookstores. I simply hand the manuscript to a publisher and get to work on the next book.

Programs, I found, were different. Even in the early days, when there wasn't much competition, marketing was more important than program quality. There was also the "product support" problem: people buy programs and they don't work. Now what?

Some companies do nothing, of course. Software is always sold with silly "licensing agreements" that say, on the one hand, that the program is so valuable that if the purchaser is ever caught giving a copy to a friend, the wretched customer is required to sell his family into slavery in partial compensation to the defrauded software publisher. But, on the other hand, the programs are certainly worthless, not warranted to do anything useful, cannot possibly be merchantable, and the seller has every right to hold the purchaser up to public ridicule if the silly goose asks for his money back. Still, consumers keep demanding that programs do something useful, and the word gets around. Companies that provide customer support make money; those that don't have decreasing sales.

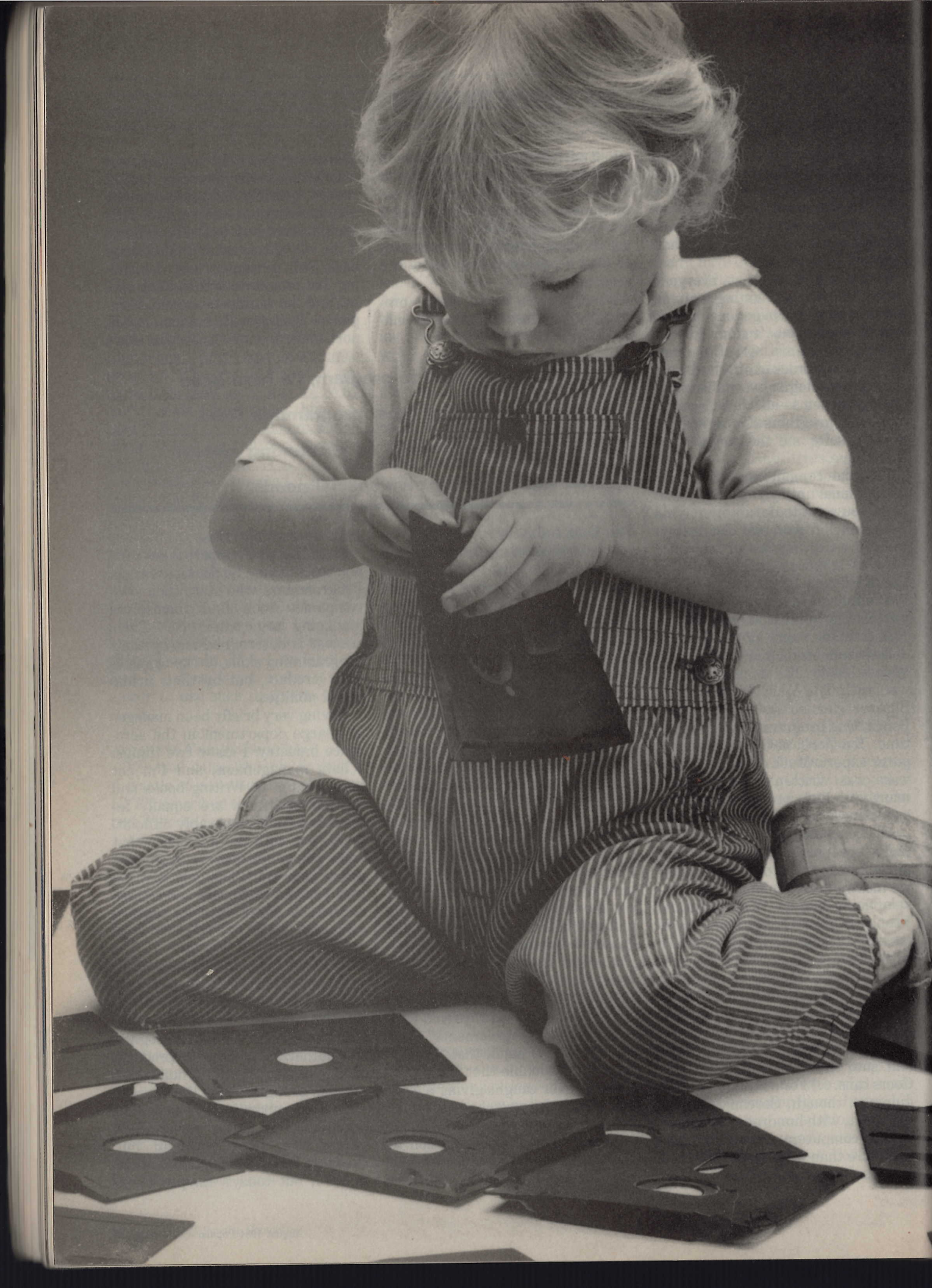
Providing that support takes time and costs money. So does marketing. Programmers who start their own companies soon find themselves managing large enterprises. Their success is determined not by their programming skills, or the worth of their product, but by their managerial abilities.

Having very briefly been manager of a large department in the aerospace industry, I know two things: I hate management, and I'm not very good at it. Writing books and writing programs are equally interesting (and comparably difficult) tasks, but with the difference that when you've finished writing a program, your work has only just begun. I stayed with books and articles because I didn't want to start a company.

**The Times, They Are A-changin'**

The situation is changing. I fully expect that the next five years will see the return of the "gifted amateur"; programs will have recognizable authors, not merely be products of an anonymous team. A number of reasons brought about the change.

First, of course, is the widespread availability of better tools. Computers are more powerful but cheaper; I paid $12,000 for Ezekial in 1977, but today's Kaypro IV is



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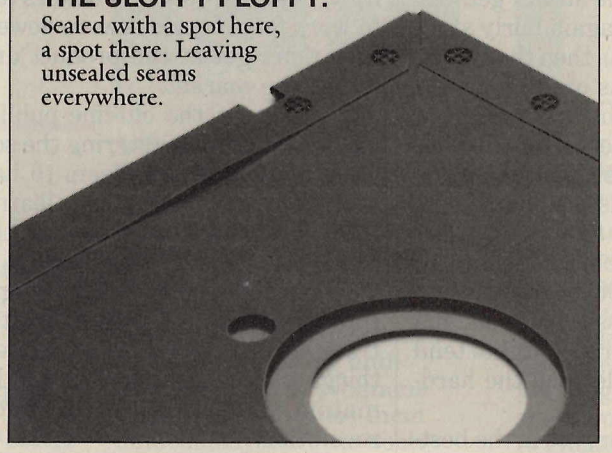

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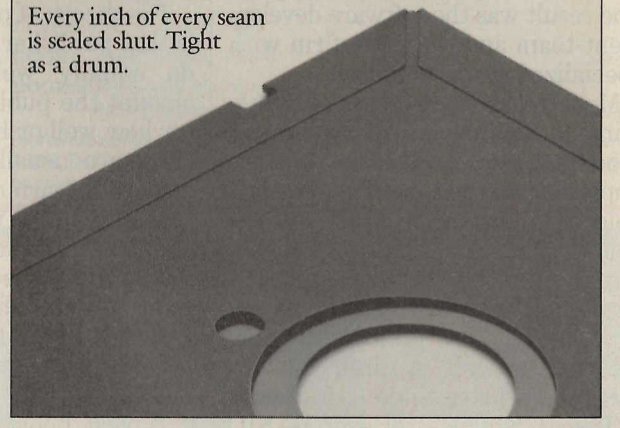

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more powerful and costs only $2000. As the hardware improves, there is a dramatic effect on programming languages. In 1978 you couldn't write a useful text-editor program unless you used assembly language; higher-level languages were just too slow and used too much memory.

Learning to program in assembly language takes special skills, lots of practice, and much time. I've never learned how to do it and never will. Assembly-language programs are not portable; programs have to be rewritten for each kind of machine. The result was the software development team and the large firm with specialized programmers.

Modern hardware allows programming in languages like Pascal and Modula-2, and these languages are improving all the time. They're portable: a program written for one machine will run, with few modifications, on a dozen other varieties. Best of all, high-level languages can be learned by almost anyone. They're difficult at first, but it's possible to learn to do useful work in Pascal, Modula-2, or even BASIC within a few weeks.

**The Perils of Self-Publishing**

Lots of people know how to read and write, but not everyone writes publishable books and articles; similarly, in the future nearly everyone will know how to program in BASIC and Pascal, but not everyone will write publishable programs. Still, the possibility will be there.

Many professional writers started by reading a book and saying "I can write a better book than that!" As more people become computer literate, I believe computer users will say the same thing about programs. Not everyone who believes he could write a better book actually writes one; not everyone who believes she could write a better program will finish the job, but enough will.

When programmers were rare, there was little opportunity for publishers. I recently met the author of the IBM PC version of the game Rogue. He started his own company to market his game. It isn't doing well. "Why," I asked, "didn't you stick to programming and let a publisher do the advertising and marketing?"

"Maybe I should," he said. "But I didn't want someone else to get rich off my work."

If every author thought that way, there would be no book business. Fortunately, most of us know better. If publishers don't make money, how can they print, bind, advertise, and market my books? I sure don't want to do that, and no publisher will do it simply as a favor to me...

The theory of publishing contracts is that publisher and author should do equally well. Advances—the amount the publisher pays no matter how well or how badly the book sells—are usually set so that the book will "earn out" within a year: that is, the first year's royalties due the author should equal the advance paid. Thus if the book stays in print after a year, the author receives royalties beyond the advance. If it doesn't, neither author nor publisher makes anything more.

Typical book advances for first novels are about $1500. If the book sells at $2.95 and the author gets 6% of the cover price (again fairly standard for first works), then the author gets about 18 cents on each paperback sold, and the book earns out at about 10,000 copies. The average paperback book sells about 40,000 copies (which means that many don't do anything like that well). The typical hardcover book sells for $15 and sells 2000 to 3000 copies; no one makes money unless it takes off, and even then the paperback rights tend to be more valuable than the hardcover.

Successful authors, not in the best-seller range, do somewhat better, with advances of $5000 to $15,000 and royalties of 8%. Best-selling writers can do a lot better than that, of course, but there aren't too many of those.

Assuming that software prices get down to $25 or less, the future market will resemble hardcovers. However, there's no inherent reason why production costs of floppy disks should be higher than those of paperbacks, and certainly ROM cartridges can be produced for under a dollar; thus really low-cost software, at $10 or less is possible.

**Support**

But what happened to the expensive support that software publishers must provide? They won't do that anymore. They won't do it because they won't have to.

When I submit a book to a publisher, it goes to an editor. His—or more typically her—job is to decide whether she wants to publish the book, and if so, to make it publishable. That means working with me until the book is right, and by right we mean not only that we preserve the book's integrity, but we also do our best to make it attract readers.

The software industry hasn't had many good editors. Authors write programs and publish their own; or they hand them over to marketers, who promote the product. But in neither case has the program been through the hands of someone skilled at working with programs and programmers to get things right. The best software editors tend to work for magazines as reviewers; they don't get at the product until it's on the market.

Fortunately, the old-line publishing companies are entering the software market. A few seem to have abandoned everything they learned from the book business, but that won't last.

When publishers learn to give software writers the consideration traditionally given to book authors, things will change. It will be another major victory for the micro revolution.

Meanwhile, I'm glad I learned how to program. It can be a welcome change from writing; and one of these days I'll have a chance to make some money without starting my own company. □

Jerry Pournelle welcomes comments from members of the micro revolution. Write to him c/o *Popular Computing*, POB 397, Hancock, NH 03449. Jerry tries to answer all his mail but cannot promise individual replies.

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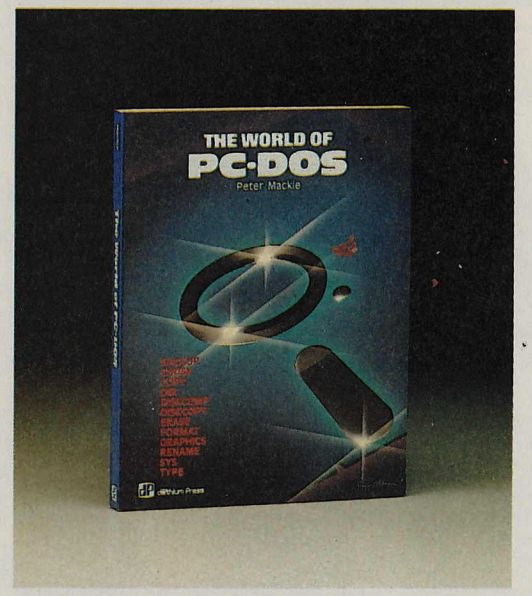


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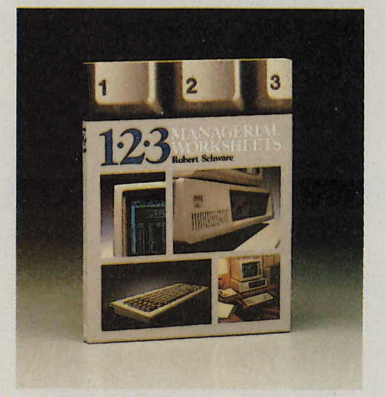


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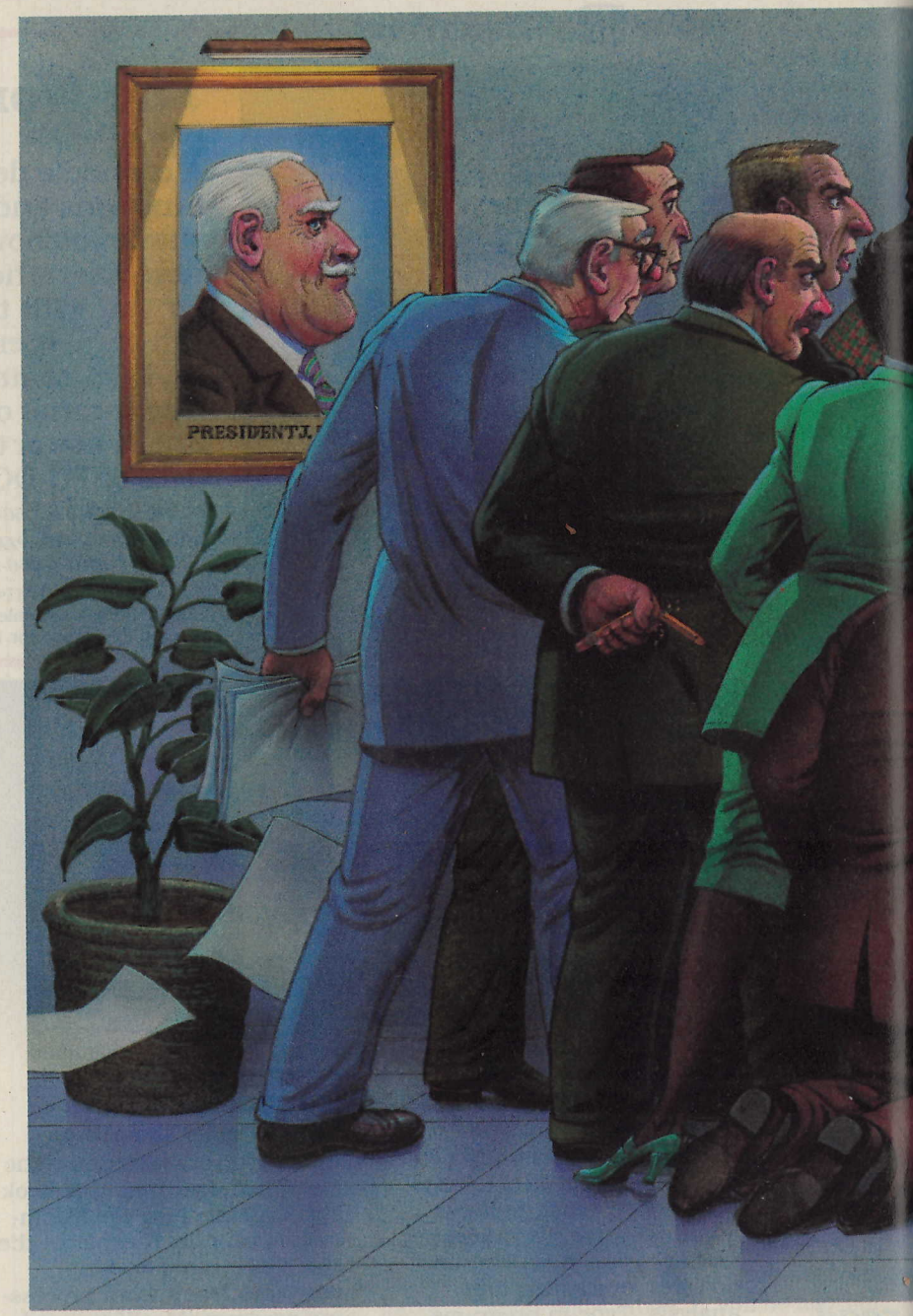


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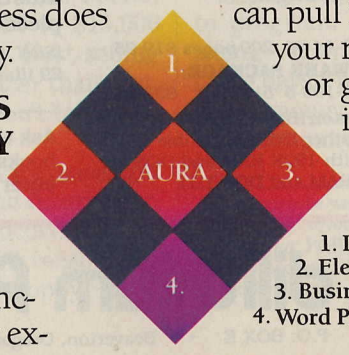


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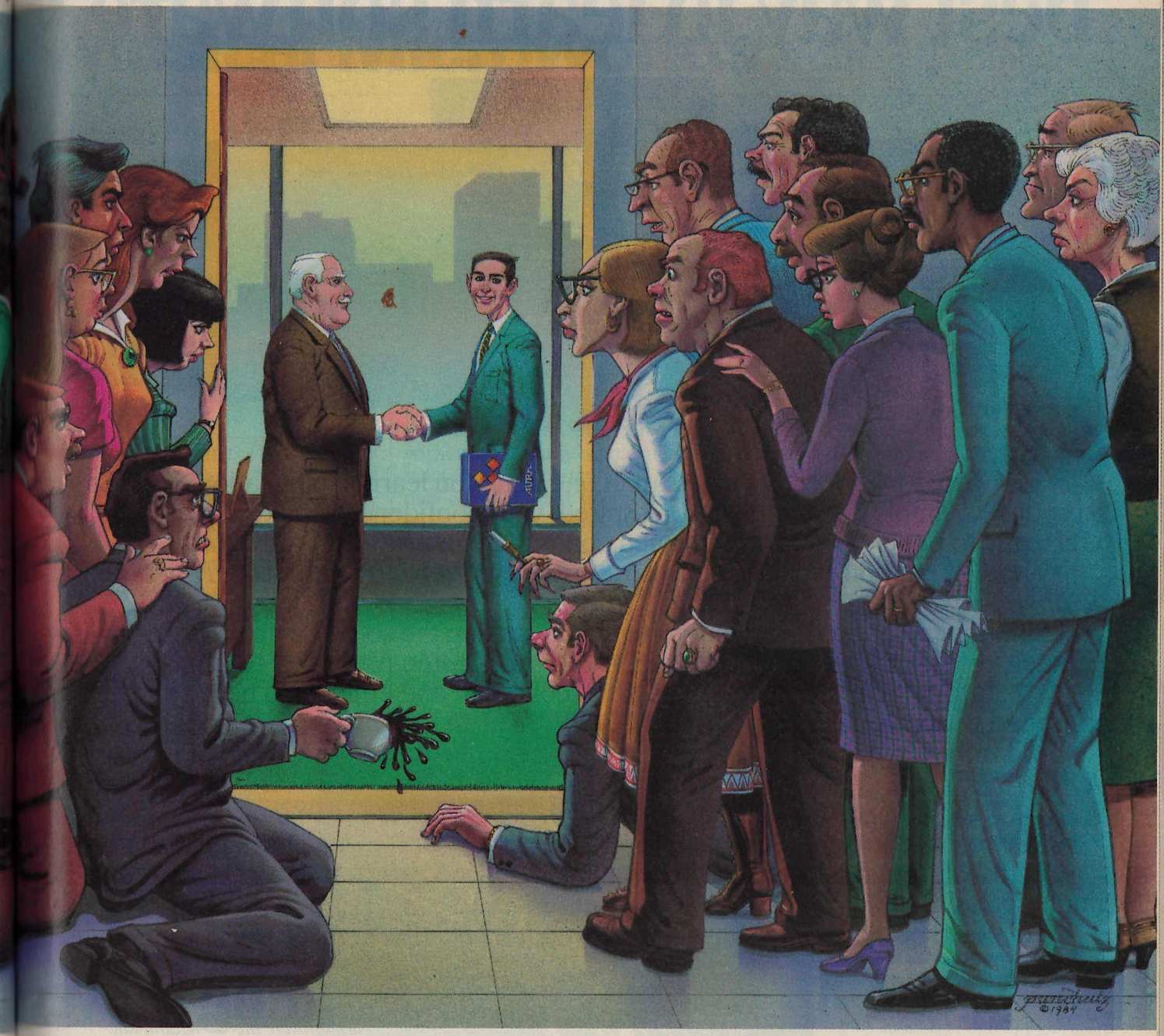

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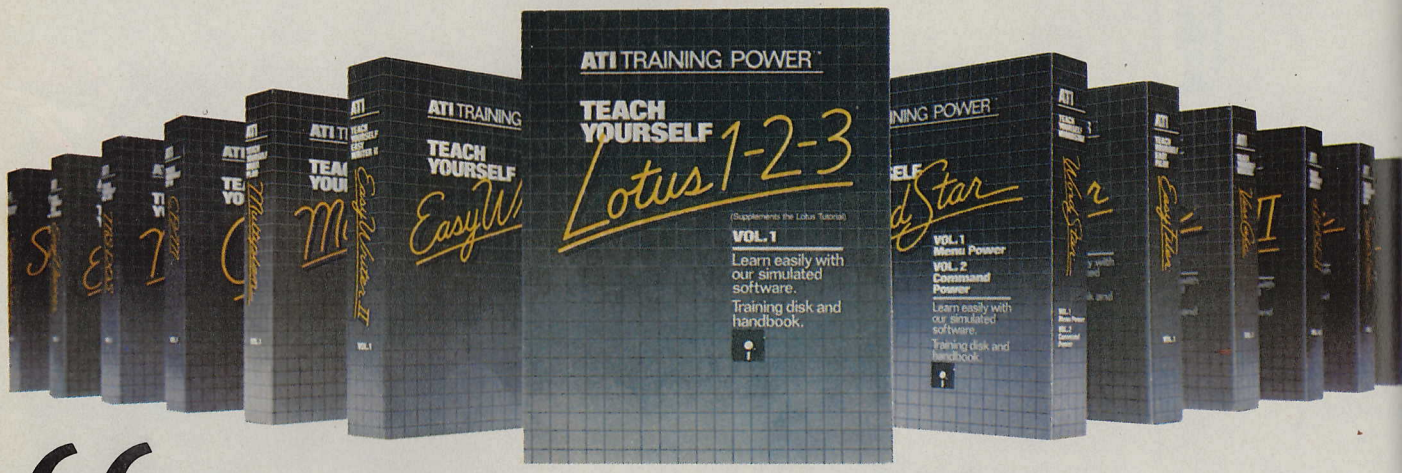


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# Musical Microworlds

*New software could lead to a breakthrough in music learning and creativity*

by Dan Watt

The sound effects blasting from arcade games and the insipid jingles accenting far too many educational programs produce a ringing in my ears. The tinny sound and insistent blandness almost convinced me that microcomputers and music would forever be incompatible.

But five new software programs not only promise a break from musical monotony, but also invite creative composition by aspiring musicians. Programs like Songwriter and Musicalc I turned a mere music appreciator into an excited participant.

Specialized hardware makes your microcomputer a simple multivoiced music synthesizer. Then, with software you build a tune and add harmony and some rhythmic accompaniment. Graphic displays illustrate your music as it plays. New forms of music notation, delightfully colored and animated, make scores easier to read and understand. Finally cut-and-paste features let you rearrange your compositions forever.

In traditional music education, budding musicians must wade through theory courses before tackling composition. But microcomputers allow anyone to experiment with musical composition without first studying harmony and mastering an instrument. Purists may complain, but microcomputers put musical creativity within reach of the masses.

Keep in mind that music represents an entirely new software genre; expect bugs and sketchy documentation. These programs make musical creativity *possible*, but they don't make it *easy*. And one last caution—your creativity still suffers from the jarring quality of microcomputer-produced electronic sound. Traditional musicians may wince a bit.

But on to the programs.

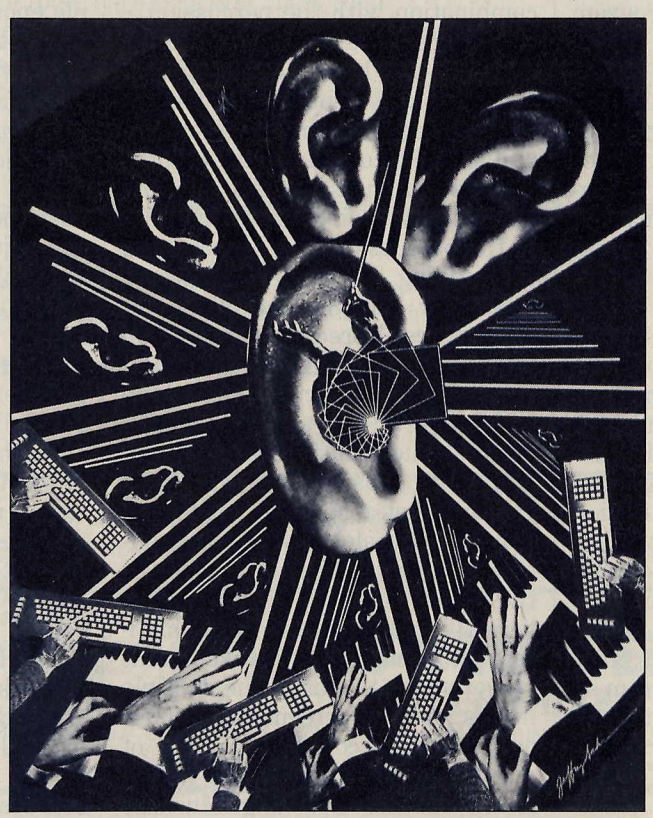

Illustration by Jeffrey Schrier

## Getting Started

Simplicity, ease of use, and excellent documentation distinguish Songwriter, a new program from Scarborough Systems. Running on an Apple IIe/II Plus without any additional hardware, it produced an acceptable sound through the Apple's built-in speaker. Like Bank Street Writer (which seems to have influenced its design) Songwriter provides extensive menus and clearly labeled single-key controls.

When you load the program, a piano-like keyboard appears at the bottom of the screen. You move a cursor right or left and press the space bar to play a note, which appears as a small rectangle and scrolls vertically up the screen. Contrast this to conventional music notation, which displays notes horizontally. Here, the notes you choose rise out of their keyboard slots on the screen keyboard. You see *and* hear your composition as it's played.

Compared to the gyrations required by most

other music software, Songwriter evidences elegant simplicity. Once you choose a few notes, you replay them one at a time, or all together, from the top. Editing is easy; scroll through your tune until you reach a place where you want to insert or delete a note. A simple keystroke or two does the trick. And once you've composed a tune or loaded it from the disk, you can alter its speed or key. Try combining songs with others stored on your disk, or make a song repeat by combining it with itself to extend your musical repertoire.

Songwriter's documentation is a model of readability. The program's target audience, young children (and their parents), wouldn't survive a complex program or awkward, sloppy instructions.

A separate program called Musical Ideas lets you playfully combine short musical phrases that you compose for yourself or load from the disk. Songwriter would be even more versatile if it enabled you to cut and paste pieces of existing tunes, letting you easily play around with precomposed music. Lack of this capability keeps the program from turning the Apple into a complete music processor. You'll need a more sophisticated program to cut and paste, add harmony, or write music for several concurrent voices in one composition. But Songwriter's simplicity makes it a natural starting point for exploring microcomputer music.

### A Musical Spreadsheet

Songwriter whetted my appetite, but Musicalc I, from Waveform Corporation, blew my mind! While not nearly as easy to use, this full-fledged music synthesizer for the Commodore 64, used in conjunction with add-on programs and a variety of musical templates, contains enough delightful features to keep me happily occupied for months. By taking advantage of the Commodore's built-in synthesizer chip, the program simultaneously plays three different musical phrases while you tinker with them. Creative learning possibilities are endless.

Musicalc's complexity makes it difficult to describe, so I'll let one experience illustrate some of its power. I loaded a jazz tune, one of the 32 preset scores that come with the program. With Voice 1 carrying the melody and Voice 3 providing a percussive riff in the background, I played along on the Commodore keyboard, substituting my input for the bass line (Voice 2).

I quickly realized that my notes didn't quite fit the tune. Simple solution—use the minor blues scale keyboard arrangement from an auxiliary disk called Keyboard Maker (an optional purchase). With my bass line sounding much better, I shifted to Keyboard Recorder mode in which the computer recorded and stored my notes. Finally satisfied that my composition sounded presentable, I quit playing and listened as my bass line played over and over again with the two original voices. Turning off the melody line clearly accentuated my bass contribution in combination with the percussion.

In Score mode, I modified individual notes and heard the changes as the tune kept repeating. I lengthened some notes, shortened others, and added a couple of runs to alter one part of the score that I found particularly boring. Listening only to the percussion line, I discovered that adding or deleting notes and raising or lowering the pitches of other notes altered the syncopation effects. After adjusting all three voices to my satisfaction, I saved the entire score on disk as Dan's Blues#1, my first micromusical composition.

Musicalc I is designed to meet varying musical needs. It will let you happily play along with many different tunes in Keyboard mode. At the same time, its flexibility and versatility stimulate more sophisticated musicians. But it takes great perseverance to master the multiple modes, assorted screens, and numerous multikey commands, each of which has different effects in different modes. Learning Musicalc from its owner's manual resembles trying to find your way around a foreign country with only a phrase book when what you need is a travel guide with suggestions for interesting places to go and maps to get you there. Without such a resource, both musicians and potential musicians may get discouraged.

### Composition as Construction

The only time I encountered conventional music notation in one of these software packages was with the Music Construction Set, from Electronic Arts. But it was notation with a difference. Borrowing the metaphor made famous in programs like Bill Budge's Pinball Construction Set and The Learning Company's Rocky's Boots, this program lets you compose music by assembling the parts.

First, you pick up individual notes—eighth notes, quarter notes, half notes and the like—with a cursor shaped like a pointing hand. Then you move the notes to a standard five-lined staff displayed at the top of the screen. The concept is simple enough, but it's difficult to pick up the tiny notes and place them exactly where you want them.

My favorite feature of the Music Construction Set is its cut-and-paste operation . A scissors-shaped cursor erases a musical phrase while a paste-pot-shaped cursor repositions it. I enjoyed being able to repeat the same phrase several times or rearrange the parts of a piece in different ways. The program, which supports two voices, also lets you experiment with chords by playing several notes at the same time.

Teachers could easily use the Music Construction Set in conventional music classes. The concise documentation focuses on traditional music theory, with minitutorials on staffs, clefs, key signatures, note values, and such. Suggested activities include transposing tunes to different keys, building harmonies, and creating variations on a theme. Additionally, the documentation wisely refers you to standard musical sources for further ideas.

Dan Watt is a contributing editor of *Popular Computing* and author of *Learning with Logo* (BYTE Books/McGraw-Hill, 1983).

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Once you've composed a picture on the screen (using a joystick or Koala Pad), the program plays the drawing as a tune. You transform your drawings by cutting, copying, or stretching, shrinking, and inverting the elements. Then, using the program called Timbre Painting, you can change your music by "painting" those elements with different sound qualities. Still another program, Sound Factory, lets you control the tone quality—the volume, harmonics, and duration of the sounds produced by the synthesizer. After creating a sound you like, you paint it on part of your original doodle. A related program, Music Blocks, lets you arrange its pieces in a variety of ways.

Musicland connects music with real events and emotions in your life, offering another form of expression for thoughts and feelings. Most children like to draw; this program makes musical composition as much fun as fingerpainting. A skilled music teacher could use it to introduce some powerful musical ideas.

The program, however, is not especially easy to use. Creating doodle-style compositions is simple enough, but composing a conventional tune with a joystick or Koala Pad is plain awkward. Also, other music composition programs provide samples of precomposed material for your experimentation. Musicland not only makes original entry difficult, but provides only one preprogrammed example, "Twinkle, Twinkle Little Star."

### Music by Menu

Music Designer II, from CAPS Software, is a sophisticated, complex tool for serious microcomputer music composers. This difficult program, designed for college-level music courses, requires an Apple IIe/II Plus with an ALF MC16 three-voice synthesizer board. Unlike the other programs, you must attend to the *sound* of the music without any graphic information or musical notation. You work directly with high-level musical elements like chords (collections of simultaneous notes), arpeggios (series of notes running up and down the scale), and counterpoint (several different melody lines played against each other).

Composing requires working your way through a series of menus. First, you select a musical form, such as chords or arpeggios, from the Choice Menu. Next, you pinpoint the specifics of your composition on a Composing Menu: volume, sound envelope (attack, duration, and decay of each note for each voice), the ratio of sound to silence, speed of play, the range of notes, scale or scales to be used, etc. In some cases you must specify change rates as well as absolute values. For example, you might rapidly increase the speed of the piece while slowly decreasing its pitch. With all the choices made, you sit back and listen.

As a casual user, I quickly got confused. My first composition turned out to be rather boring and unlike any music I've ever heard. Altering the piece meant traipsing through the menus again, choosing different variables. And I soon discovered the necessity of keeping track of my choices because the software doesn't keep any visible record of them.

Actually, it isn't fair to compare this sophisticated program with software designed for home computer use. The design features that make it difficult for a casual user, however, could be extremely effective in a serious music class. Enthusiastic students, an experienced teacher, and Music Designer II would be a dynamic combination.

### A Final Note

Music software for microcomputers brings new creative opportunities albeit with some shortcomings that may frustrate eager users. But its enormous teaching potential, coupled with insights from users, should encourage developers to create even more powerful music software in the near future.

The synthesizer won't replace the string quartet, symphony orchestra, or brass band. Traditional instruments will never be supplanted by electronic imitations, no matter how sophisticated. But microcomputers enhance musical creativity for the masses, and if music educators, parents, and kids adopt these programs, we might experience a renaissance of musical participation. Let the music begin! □

### For Further Information

**Musicalc I** (Waveform Corporation, 1912 Bonita Way, Berkeley, CA 94704, (415) 841-9866). For the Commodore 64, $49.95.

**Music Construction Set** (Electronic Arts, 2755 Campus Drive, San Mateo, CA 94403, (415) 571-7171). For the Apple IIe/II Plus (requires Mockingboard synthesizer, $124.95, from Sweet Micro, (800) 341-8001); Atari, Commodore 64, $40.

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**Musicland** (Syntauri Corporation, Suite 116, 1670 South Amphlett Blvd., San Mateo, CA 94402, (415) 574-3335). For the Apple IIe/II Plus (requires Musicsystem synthesizer board from Mountain Computer Inc.), $149 ($495 with board).

**Songwriter** (Scarborough Systems Inc., 25 North Broadway, Tarrytown, NY 10591, (914) 332-4545). For the Apple IIe/II Plus, Atari, Commodore 64, $39.95; IBM PC, $49.95.

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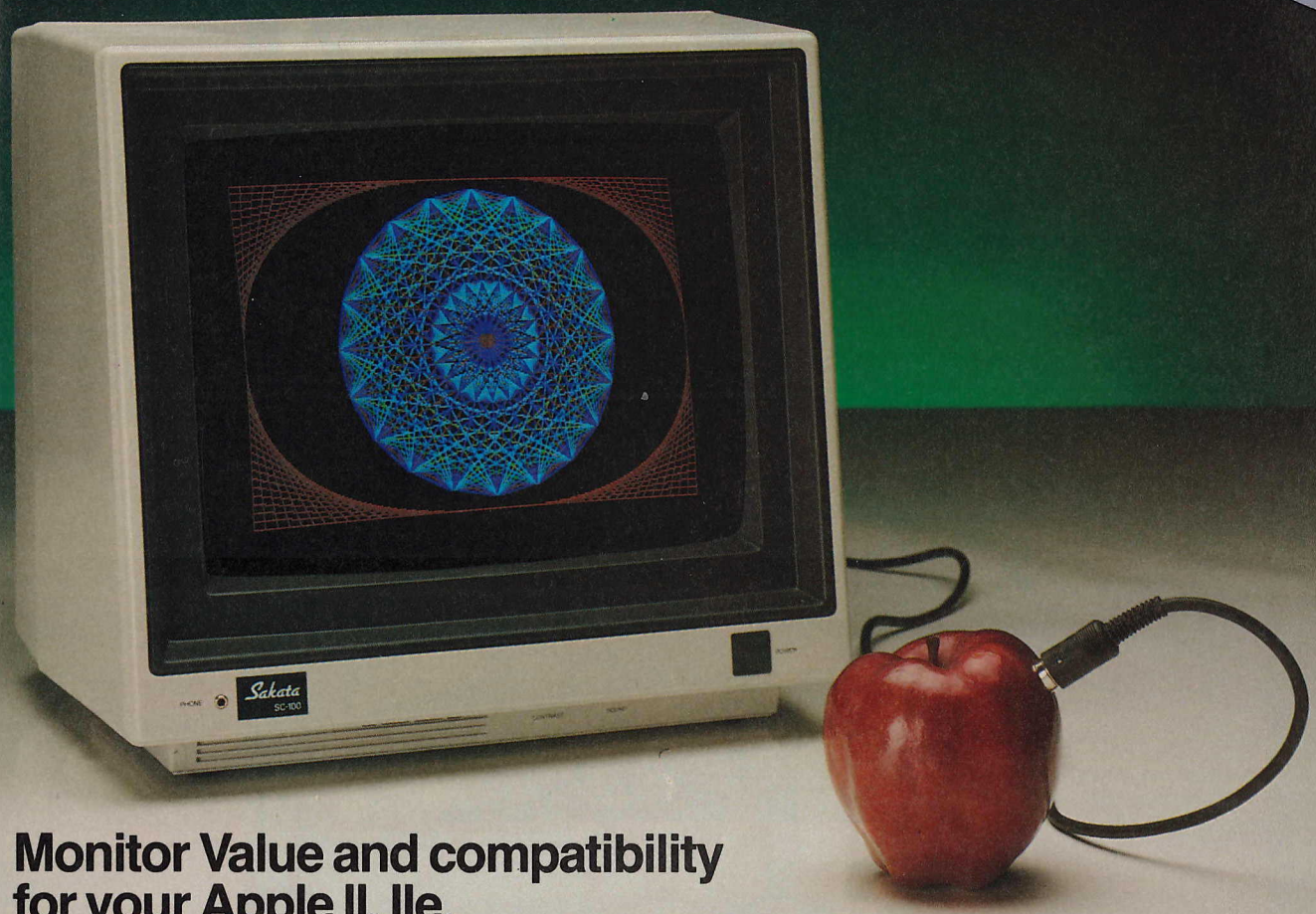


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**Music Designer II** (CAPS Software, 4024 Alto St., Oceanside, CA 92056, (619) 724-0492). For the Apple IIe/II Plus (requires MC16 synthesizer, $179, from ALF), $49.95.

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**Songwriter** (Scarborough Systems Inc., 25 North Broadway, Tarrytown, NY 10591, (914) 332-4545). For the Apple IIe/II Plus, Atari, Commodore 64, $39.95; IBM PC, $49.95.

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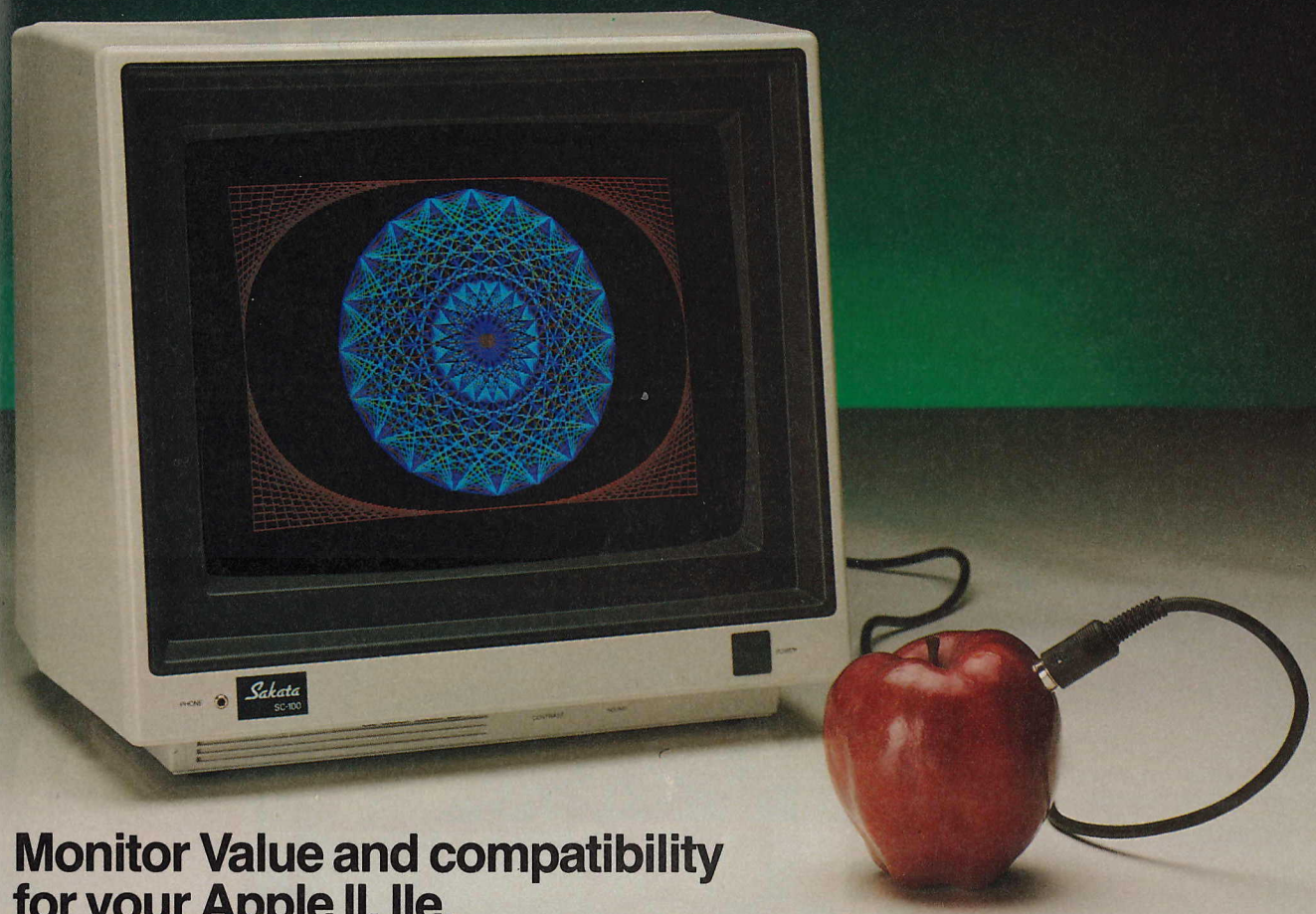


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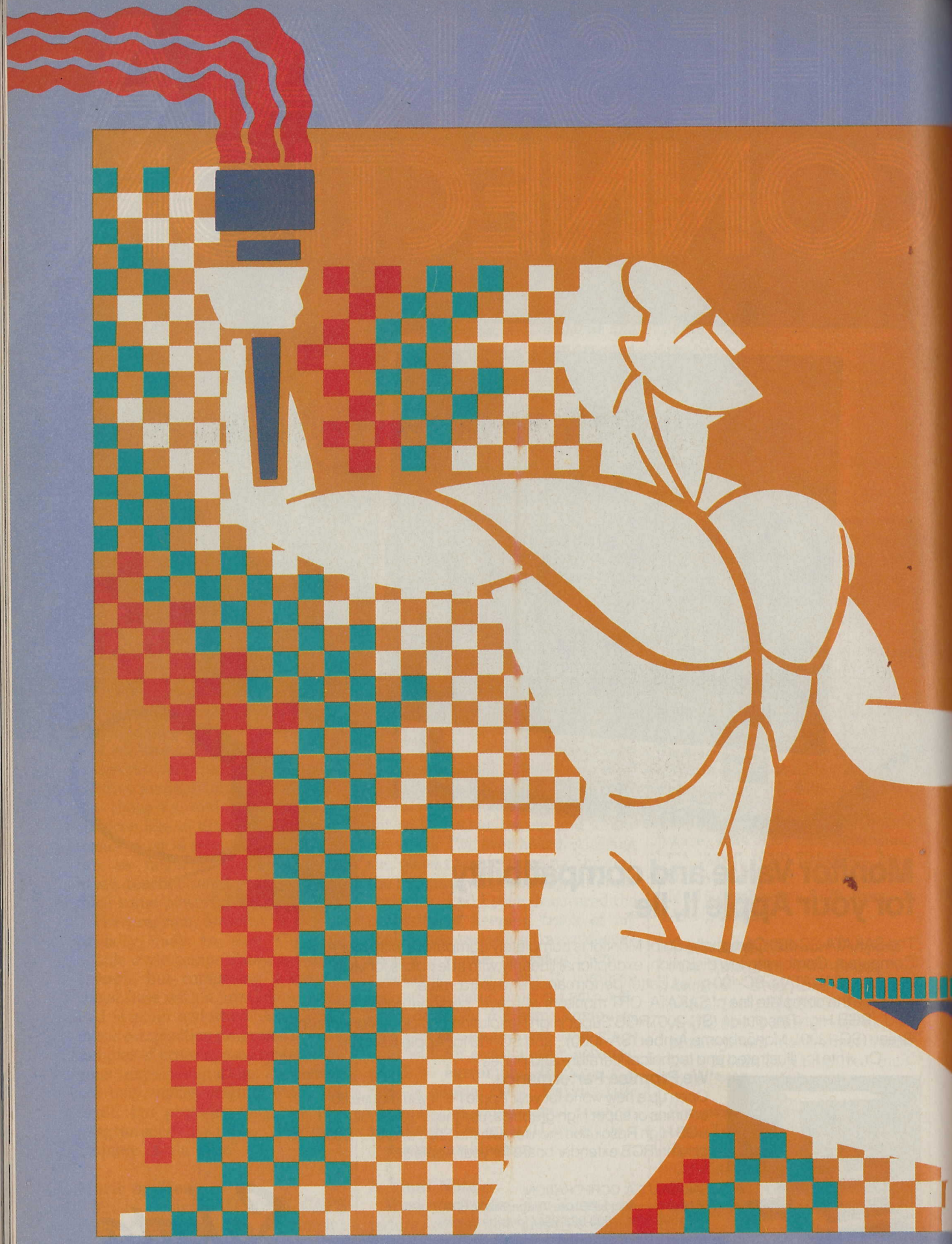


# THE COMPUTERIZING OF THE OLYMPICS

*America goes for the gold in high technology at the XXIII Olympiad*

**FIELD TEST AT USC**

**USC's new Swim Stadium saw the first test of AT&T's Electronic Messaging System.**

COVER STORY

by Bernie Ward and Thomas Maremaa

An invisible competitor will be participating in this summer's Olympic Games in Los Angeles. Though you won't see him on any basketball court or running field, his presence will be felt. As coach, he will have taught sprinters to run faster, long jumpers to leap farther; as trainer, he will have tested the muscle strength, power, endurance, aerobic and anaerobic capacities of countless athletes seeking to improve their performances. This new competitor is the computer.

Bernie Ward is a writer who lives in Lake Worth, Florida. Thomas Maremaa is an editor of *Popular Computing*.

Illustration by John Martinez

Indeed, from biomechanical training and security of Olympic athletes to ticketing and information flow for the spectators, the computer is playing a major role in virtually all aspects of the Games. You won't be able to buy a ticket, watch an event, keep score, look up a performer's past records, or even walk around and enjoy the festivities of Olympic stadium without encountering, at some point along the way, the presence of the computer.

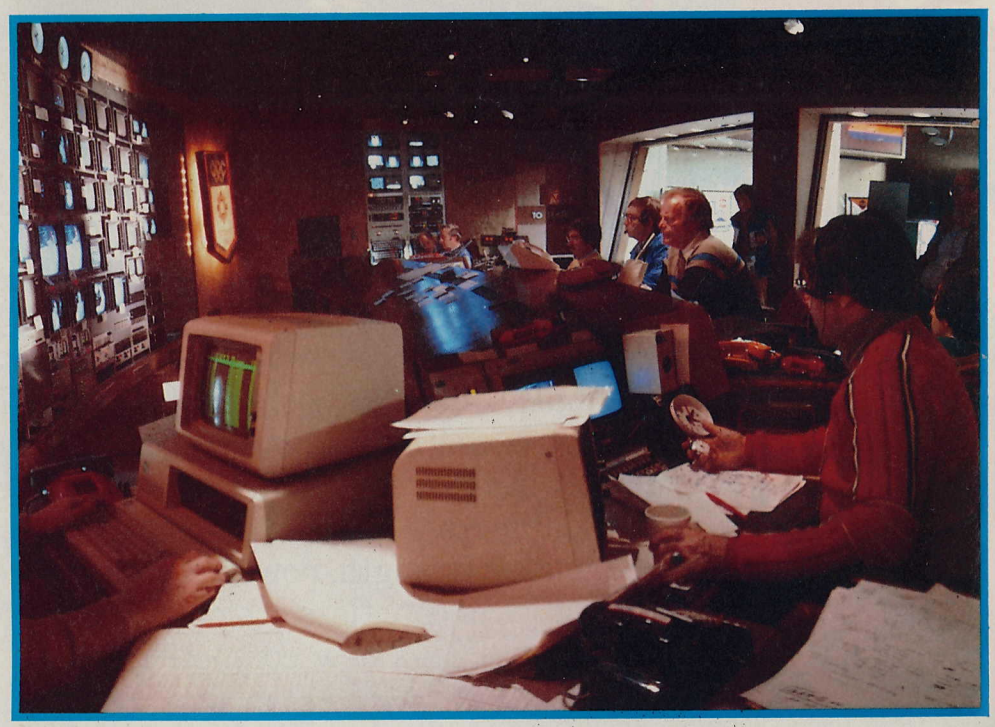
What we're seeing, undoubtedly for the first time in history, is what some have called a Technology Olympics, a fierce battle among nations for superiority in technology as much as for gold on the field of competition. Remember, first of all, that these are the first Summer Games the United States has fully participated in since Montreal in 1976. Consider, then, the astonishing advances in technology, particularly in computer science, that have occurred during those eight years.

In this article, we'll preview this First Technology Olympics and look closely at the technological advances achieved in the following areas:

**Enhanced television coverage:** To appreciate the extent to which new technologies will dominate the Games, you need only to look at the enormous commitment that ABC has made to prime-time television coverage. The network has laid out a cool $225 million to provide us with 187½ hours of in-depth coverage (compared to the 75½ hours at Montreal) complete with some dazzling computer graphics. Some 2.5 billion people in 130 countries are expected to watch via satellite.

**Championship communications:** If you happen to be among the 10,000 or more athletes competing in the Games or the 12,000 journalists covering them, you'll no doubt be pleased to discover that you can receive information through a communications system of unprecedented sophistication. And to send information you can communicate via an innovative electronic messaging system or a telephone messaging system that can translate messages into any of 10 languages. If you're among the lucky 7 million ticket holders, you'll find very user-friendly terminals at your disposal located at visitor centers around the various complexes. With those, you'll be able to locate nearby services, find rooms to rent, and even swap tickets.

**Biomechanical training:** Down on the playing fields, where heroes are born and hundreds of human dramas are played out, the impact of the new technology will be profound. Already being hailed as perhaps the strongest U.S. team ever, many of our athletes are the prototypes of a new breed of Olympic champion—the initial products of an aggressive, multimillion-dollar technological leap by this country's sports scientists into the relatively new field of biomechanics. Biomechanics, the science of movement, force, and velocity as they pertain



**TV NERVE CENTER**

**An electronic control room (right) is the nerve center of ABC's Olympic coverage. The Quantel 7000 (above) provides dazzling video enhancements.**



Photographs © 1984 ABC

to muscular activity, might still be languishing in theory only were it not for the power of the computer to see and analyze what the eye cannot.

The true Olympic champion is one who reaches that goal through a combination of magnificently conditioned muscle and sinew, innate ability, exceptional coaching, and the best nutrition. A computer does not a champion make. But in the eight years since Montreal, it has become such a pervasive and powerful tool in the training regimen that, for future champions, scrutiny by the computer will be a routine waystop on the long hard road to the gold.

*Computers will be performing hundreds of tasks behind the scenes at the Summer Games*

**IBM POWERS LAOOC**

**The Los Angeles Olympic Organizing Committee takes advantage of equipment donated by IBM.**

### Flashy Television Coverage

As we can expect, ABC's television coverage of the Games will be at once dazzling and exhaustive—with a smorgasbord of graphics, replays, highlights, interviews, athlete profiles, and the like. Not surprisingly, computers are at the heart of what Julius Barnathan, president of ABC's Broadcast Operations and Engineering division, calls "the most sophisticated technical operation we, or any other network, have ever attempted."

When Jim McKay and his cohorts describe the action on the field, they'll be speaking from a technical nerve center that is crammed with custom-designed computer equipment that feeds into the network's huge IBM mainframes in New Jersey. That nerve center is a "portable" control room (with an identical control room as backup) that ABC engineers have constructed especially for the Games and dubbed, appropriately enough, Olympic Village.

From that vantage point, as many as 70 monitors will track the action with more tape machines, more special-effects generators, and more machines with special graphics capabilities than have ever been assembled for a single production. "With the aid of computers, our graphics capabilities are virtually limitless," says Barnathan. A three-dimensional look can now be applied to charts and diagrams, for example. Graphics that might have taken days to create in the 1980 Olympics can be generated by new or technically improved machines in a matter of seconds, according to Barnathan.

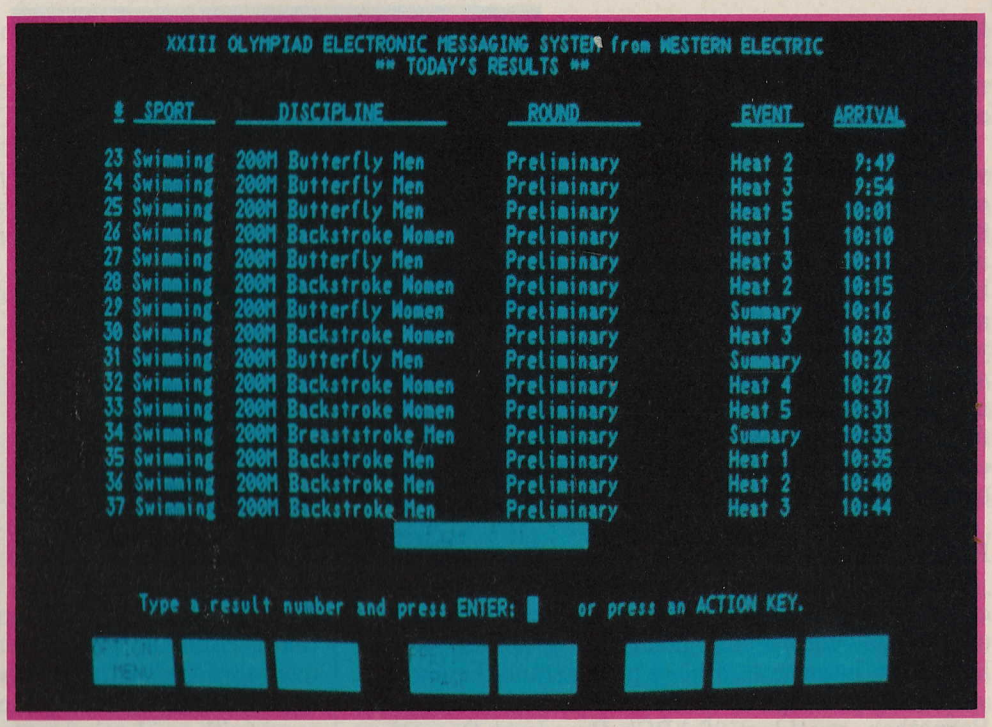
A technical marvel most likely to enchant those of us who are watching the Games on television is a Quantel 7000 computer "paintbox." ABC graphic artists will use this machine to create effects on a digitized electronic palette. The paintbox, which can store up to 200 different frames of video for the artist to enhance by recoloring or drawing in additional details, is new to this

**LAOOC LEARNS EMS**

**A seminar for employees and volunteers familiarizes them with the Electronic Messaging System.**

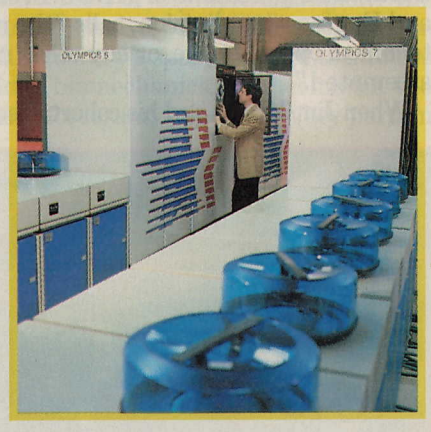
Photographs by Steve Smith/Wheeler Pictures

*Financing and support for the Olympic Games comes not from tax money but from more than 35 corporate sponsors*


XXIII OLYMPIAD ELECTRONIC MESSAGING SYSTEM from WESTERN ELECTRIC
** TODAY'S RESULTS **
# SPORT DISCIPLINE ROUND EVENT ARRIVAL
23 Swimming 200M Butterfly Men Preliminary Heat 2 9:49
24 Swimming 200M Butterfly Men Preliminary Heat 3 9:54
25 Swimming 200M Butterfly Men Preliminary Heat 5 10:01
26 Swimming 200M Backstroke Women Preliminary Heat 1 10:10
27 Swimming 200M Butterfly Men Preliminary Heat 3 10:11
28 Swimming 200M Backstroke Women Preliminary Heat 2 10:15
29 Swimming 200M Butterfly Women Preliminary Summary 10:16
30 Swimming 200M Backstroke Women Preliminary Heat 3 10:23
31 Swimming 200M Butterfly Men Preliminary Summary 10:26
32 Swimming 200M Backstroke Women Preliminary Heat 4 10:27
33 Swimming 200M Backstroke Women Preliminary Heat 5 10:31
34 Swimming 200M Breaststroke Men Preliminary Summary 10:33
35 Swimming 200M Backstroke Men Preliminary Heat 1 10:35
36 Swimming 200M Backstroke Men Preliminary Heat 2 10:40
37 Swimming 200M Backstroke Men Preliminary Heat 3 10:44
Type a result number and press ENTER: or press an ACTION KEY.

**AT&T KEEPS SCORE**

**Electronic Messaging System (top), Digital Television Lightwave System (bottom left), and minicomputer-based data center (bottom right) are all from AT&T.**



Olympics. The palette has an incredible 4000 colors to select from, and the paintbox is capable of producing animation as well as three-dimensional effects.

To edit graphic images, the ABC broadcast center is equipped with 41 Ampex VPR 3s—a new version of the one-inch type C videotape machine that has been specially designed to meet the network's Olympic needs. These tape machines, driven by computer software, can fast forward or rewind at 50 times normal speed. The new Interactive Systems Corp. control and editing system (another Olympic first) is a cross between basic remote tape editing and sophisticated computerized tape editing. A special feature of the new system is its SMPTE (Society of Motion Picture and Television Engineers) serial interface, which gives it the ability to switch the operation of the tape machines easily from record to playback. Also, up to six machines can be interconnected through computer control to further enhance production capabilities.

### Championship Coordination and Communications

Behind the scenes, the entire administrative structure of the Los Angeles Olympic Organizing Committee (LAOOC) has been totally computerized in order to handle the monster task of coordinating the almost inexhaustible technical and logistical details of the Games. For months, the LAOOC has grappled with problems of security (the tightest in history with the world's most sophisticated intelligence computers linked up to help track international terrorists), scheduling, accounting, transportation, and ticketing involving over 43,000 employees and volunteers scattered throughout 60 sites, including three Olympic Villages, 23 sports locations (some up to 190 miles apart), security posts, press



Photographs (top and bottom left) courtesy of AT&T; (bottom right) by Steve Smith/Wheeler Pictures

**EMS LOGO**

**AT&T has created this pictogram (below) to identify EMS locations.**

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**LA DATA CENTER**

**At AT&T's data center in downtown Los Angeles (left), 14 3B20S minicomputers will be used to compile results from Olympic events at all 23 arenas and locations.**

centers, and the LAOOC headquarters. Needless to say, without the aid of computers, much of this work wouldn't have been accomplished at all, certainly not in time for the Games.

A notable feature of the 1984 Games, and one that seems remarkable in light of past Olympic history, is that they are being put together without a dime of public tax money. Financing and support are coming from at least 35 corporate sponsors, many of them major American companies whose own vital interests are in computers and high technology.

McDonnell Douglas Automation Company, for example, is providing the computer service that will process the results for the Games. Thanks to the company's computers in Long Beach, individual and team results will be compiled and then transmitted over telecommunication lines for processing and tabulation at AT&T's data center in downtown Los Angeles. Those results will then be flashed back to the event locations, press centers, and LAOOC headquarters, where they'll be available on display screens and as computer printouts.

Here's how it works. Computers will handle much of the scoring and judging, with the results flashed instantaneously to control centers along an elaborate fiber-optic highway that knits together the huge Olympic complexes. A special device will link the starter's gun with photo-finish cameras that are capable of pinpointing separations of as little as two millimeters. Long-jumping events will be measured by a slide carriage trained on an optical detector that measures down to the millimeter. Shotput, discus, and javelin throws will be measured by a trigonometrical formula on a portable calculator. All of these results will be instantly processed

Photograph by Steve Smith/Wheeler Pictures

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# How to move with
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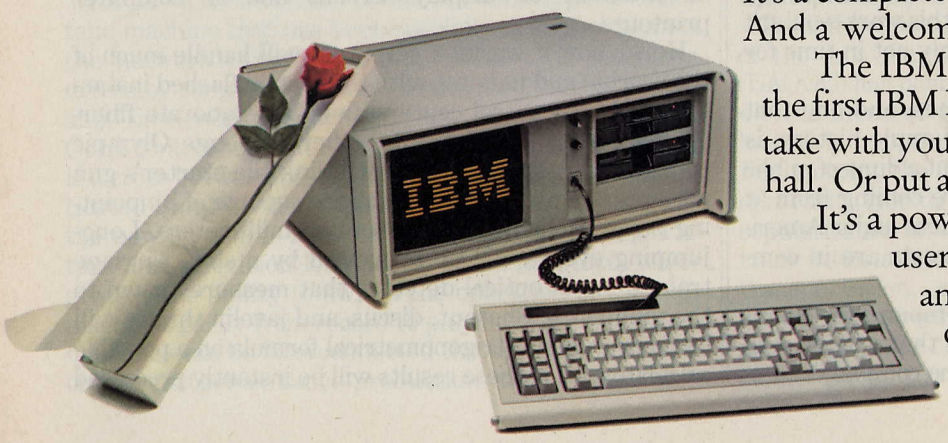


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by the McDonnell Douglas computers in Long Beach.

In the area of personal communications, AT&T has developed a unique voice, data, and television communications system to serve the needs of the 70,000 to 80,000 athletes, coaches, staff, officials, and press who'll crowd into Southern California for the 16 frenetic days of the Olympiad. In addition, the system will help smooth the way for the estimated 7 to 10 million spectators who would otherwise simply overwhelm the area's present communications and transportation systems.

*Through the Electronic Messaging System, reporters will get event results one minute after they've been certified*

To accomplish this formidable task, AT&T has installed one of the largest specialized telephone systems ever developed, with some 7000 special phones and more than 20 Dimension PBXs equipped with such standard features as call-waiting, call-forwarding, add-on conferencing, and automatic call-back. The entire system is custom-tailored to Olympic needs with special touches such as telephones with lights instead of bells at certain locations to avoid distracting athletes and, at Lake Casitas, where the rowing and canoeing events will be held, phone cables that run underwater to the judges' stands on floating log rafts.

Information will be distributed through an elaborate Electronic Messaging System (EMS) that utilizes 14 AT&T 3B20S super minicomputers, 1700 new AT&T Model 5410 Teletype terminals with 12-inch high-resolution screens to reduce glare, in addition to 300 AT&T Model T300 high-speed printers. Through EMS, reporters will be able to get event results one minute after they've been certified. Also, journalists will have access through EMS to comprehensive reports and schedules, athlete profiles, and other valuable information as well as enjoy the benefits of electronic person-to-person mail 24 hours a day. (Messages are stored in the computer until requested.) As designed, EMS is easy to use, offering a menu of options in English and French; most operations require pressing only a single key.

The system should be particularly valuable to the thousands of print and electronic journalists from all over the world who will be covering the Games. Special messaging stations will be available to journalists at the International Broadcast Center in Hollywood, at the press headquarters in the Los Angeles Convention Center, and at each separate sports location. Without leaving their seats in the press section, reporters will be able to write their stories on a terminal using the data query function and file them directly with their editors almost anywhere in the world by means of the system's link to the international telex network. And, if that isn't enough, journalists can receive hard-copy printouts of their dispatches and will have random access to athlete profiles and biographies, event schedules, and individual results to add color and commentary to their stories or to update information rapidly.

A local area network will link the computers in the EMS system. The local network is interconnected to the main communications network by an AT&T fiber-optic lightwave system installed for Pacific Bell. Each cable in the lightwave system is about the thickness of a little finger and contains 144 individually spun glass fibers capable of transmitting 240,000 simultaneous conversations in the form of laser-generated coded light pulses.

The Olympic lightwave system represents a series of "branches" linked to an existing California fiber-optic "highway" and is augmented with an AT&T Digital Television Lightwave System (DTLS). The whole system is linked to radio paging services and to the international telex network via the AT&T data center. And with that complex hookup, instant communication is possible both within Southern California and with the outside world.

Much of the computer, microelectronic, software, and lightwave technologies such as EMS has been created by AT&T especially for the Games. These are largely customized systems that have not yet been marketed to the public. But when they are, as with the Space Program, we'll all begin to reap the benefits of this new technology that the Games will spin off. We can only speculate as to what, ultimately, these will be, but certainly AT&T's highly innovative Electronic Messaging System will find ready applications in the private sector.

### Vaulting Over the Language Barrier

Another corporate giant that is making a contribution to the LAOOC is IBM. In contrast to AT&T, with its sophisticated, state-of-the-art systems, Big Blue is relying primarily on existing hardware and software as part of its $4-million-plus donation to the Games. More than 200 IBM Personal Computers and an equal number of Displaywriter systems have been loaned, mostly to handle administrative chores. The PCs have been used to coordinate details of planning, inventory, housing, matching equipment and facilities with teams and to monitor and update budgets.

During the Games, PCs will also be used at various sites for record-keeping purposes, keeping track of

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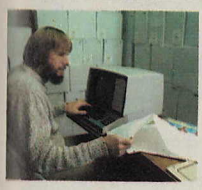

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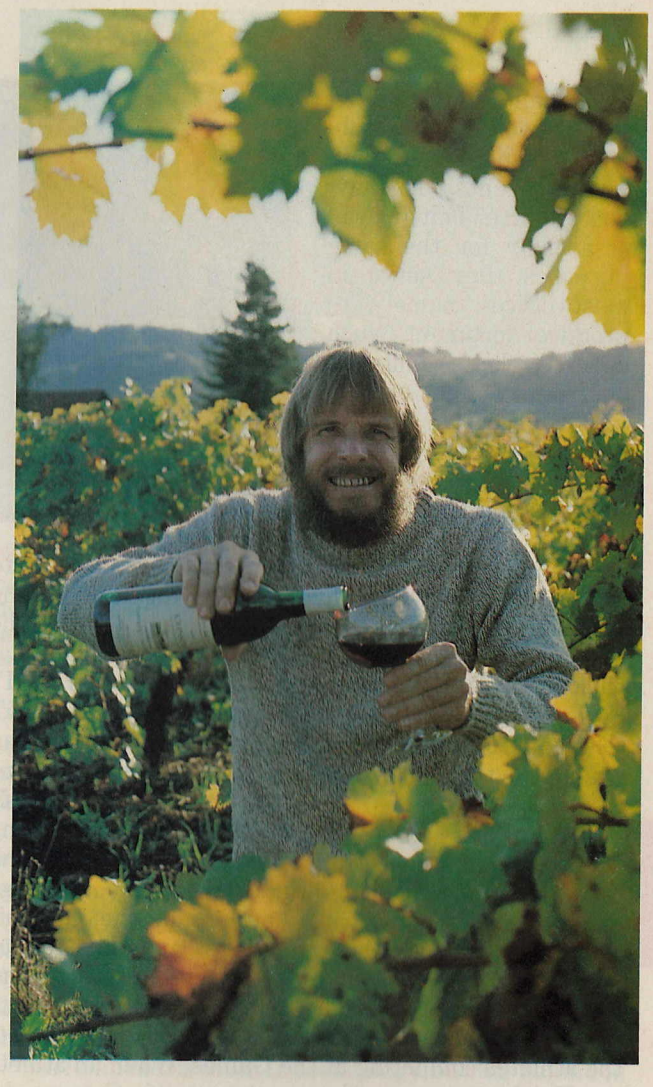

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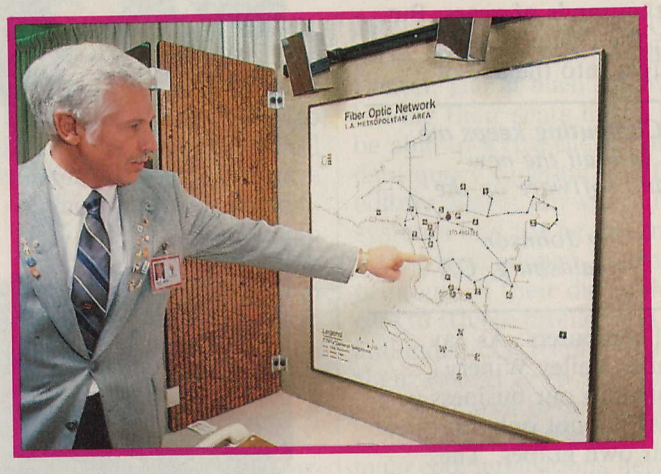
events and sports statistics, as well as for establishing rankings in individual events. Displaywriters are being used essentially for the same purposes they serve in most offices, namely, to produce documents such as press releases, bulletins, correspondence (up to 20,000 letters per month), contracts, translations, mailing lists, operating plans, and official hotel listings.

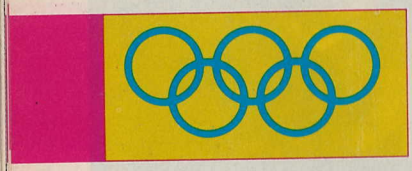



ANNETTE DEL ZOPPO

**FIBER-OPTIC LINK**

**A network of fiber-optic cables capable of 240,000 simultaneous transmissions will link the data center (left) with sites like USC's Olympic Swim Stadium (above and below).**

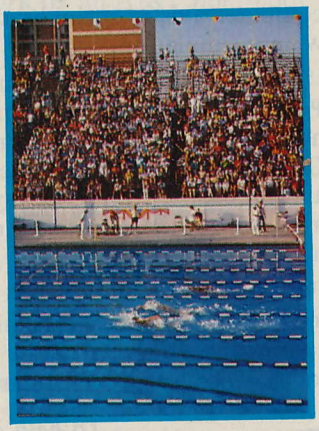
As an example of the way that these rival corporate giants, AT&T and IBM, have worked together for the common Olympic good, you can look at the seven Audio Distribution Systems (ADS) that IBM has installed at various Olympic Villages and offices. Based on IBM's Series I processor, ADS is designed to enhance AT&T telephone communications and reduce telephone tag among the thousands of people both behind the scenes and on the field. Significantly, ADS will go a long way toward helping eliminate the many language barriers in the Olympic Villages and thus reduce the expense of hiring translators. These customized System/38s can accommodate up to 10 languages, which are spoken by 95 percent of the athletes competing at the Games. When an athlete or official wants to send a message, say in German, he simply signs onto the system, specifying the language of the receiver. That message is then delivered electronically in the language understood by the recipient.



### The U.S. Enters the Biomechanical Marathon

But the computer is having its most awesome, far-reaching impact on the athletes themselves.

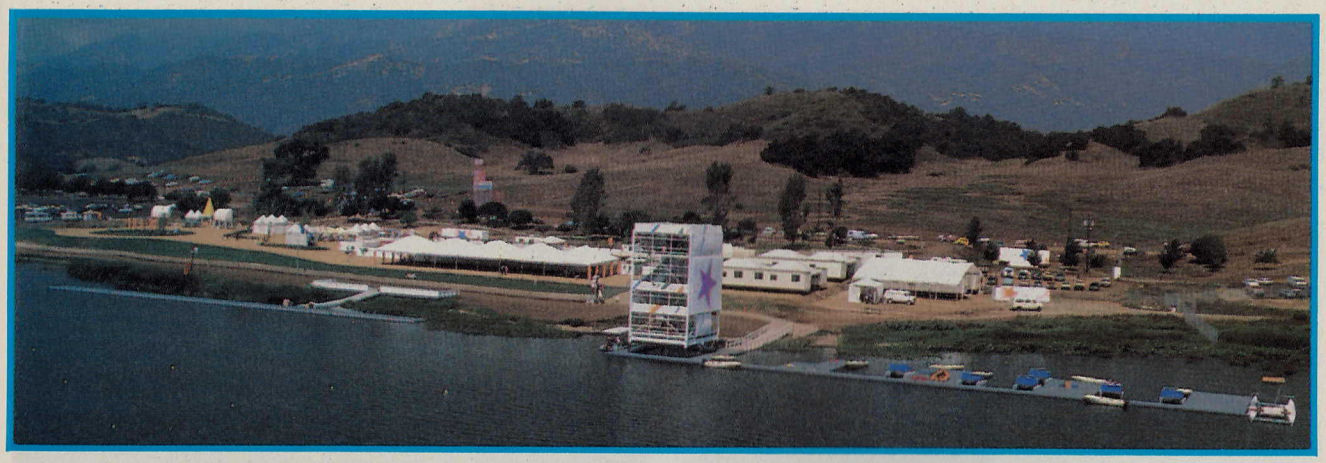
For years, the East Germans and other Eastern Europeans have been in the forefront of applying technological innovations to equipment and training methods, while the United States, the world's most technologically advanced nation, has failed to keep up. The eight years that have intervened since we last participated in a Summer Olympics have given American athletes, coaches, and sports scientists an opportunity to reflect, reassess, and redirect their efforts. And now, with a whole new arsenal of computer technology at their disposal, they appear to be catching up with the competition and are ready to compete on more equal terms.



It all began at the Olympic Training Center in Colorado Springs, Colorado, in what is fittingly called the Elite Athlete Project. Here in the mountains is focused much of the United States Olympic Committee's (USOC) $80 million commitment to providing U.S. athletes with a competitive edge. Over the past two years, for example, hundreds of athletes have been tested by computer analysis at the Center's physiology unit. The Center also supports biomechanical research projects around the country. These include Elite Athlete programs in archery, cycling, diving, fencing, hammer throw, high jump, horizontal jump, hurdles, javelin, pole vault, shotput, discus, sprinting, team handball, men's and women's volleyball, and last but not least, weightlifting.

Biomechanics is a new science. The Training Center's lab has been in existence for only four years, and some sports scientists say that it is too early to rave about computer-improved performances. Leonard Jansen, the systems manager at the Center and a champion racewalker, is one of those who takes a cautious approach to the subject: "We're involved with high-quality research, and we don't make extravagant claims with no hard data to back it up."

Up until two years ago, Jansen recalls, the place was "absolutely bare" except for one computer and now "we're tripping over equipment." The main scientific computing system being used by the USOC's Sports Medicine Division is a Data General Eclipse S/250. A 16-bit mini, the computer has been upgraded to meet



**PRESS ROOM AT USC**

**Terminals at the Olympic Swim Stadium (left) provide instant access to results of any event.**

**FAR-FLUNG SITES**

**Results of rowing, canoeing, and kayaking events will be transmitted from Lake Casitas (above).**

the growing needs of both the physiology and biomechanics laboratories. Data General has also donated a number of MPT/100 micros as well as software for file management at the Center.

"We're doing science here, not miracles," says Jansen. Briefly, the principles of biomechanics involve the study of two factors in athletic performance: efficiency of movement and good technique. In working with an injured marathon runner, Tony Sandoval, Jansen and his colleagues shot high-speed videos of Sandoval running on a treadmill, focusing on lower ankle and knee areas that were creating problems for him. By digitizing that information and feeding it into the computer, it was possible to measure certain angles and analyze the data to determine how much the runner's foot was pronating. "Tony was rolling his foot inward too much," says Jansen. "It's a common problem among distance runners."

After pinpointing the problem, Jansen was able to prescribe a series of exercises to strengthen the inside of the runner's foot. Four to six months later, the marathoner returned, having followed the recommendations based on computer analysis, and the pronation had been cut in half, according to Jansen.

"The goal is to start a ground swell for computer analysis in all sports, and when that happens, there won't be a country in the world that can match us," Jansen predicts.

At the moment, though, in certain sports such as weightlifting, the Soviets and Eastern bloc countries have clearly enjoyed a significant margin of superiority. As of this writing the Soviets and East Germans plan to boycott the Summer Olympics. It's unfortunate that American weightlifters such as Mario Martinez, John Bergman, Kurt White, and Ken Clark may not have the chance to find out if they are closing the gap.

"We're ahead of them in technology but lag behind in terms of practical applications," says Harvey Newton, U.S. Federation Olympic weightlifting coach, who also works at the Elite Athlete Project in Colorado Springs. A pool of Soviet sports scientists constantly study the performances of their weightlifters and on the basis of information gleaned from their analyses are able to suggest changes and adjustments. Also, weightlifting is a hugely popular sport in the Soviet Union, attracting as many as 300,000 participants, compared with only a few thousand in this country. "The Soviet athletes have more room to experiment," says Newton.

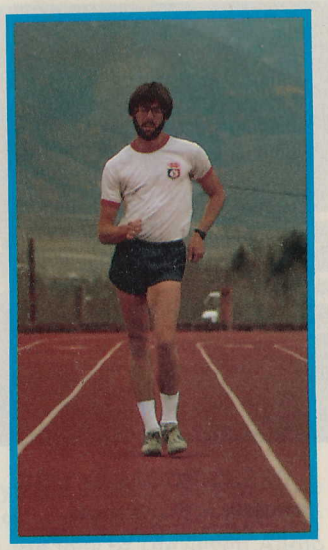
Such factors as the trajectory of the bar (what path it should follow in a lift), power outputs, and center of gravity are considered in the computer analysis of our Olympic hopefuls. In filming our weightlifters and comparing their techniques with those of the Soviets, one can see that in both the snatch and the clean and jerk, the Soviet men move quickly under the bar and literally explode upward with their legs. Our weightlifters have a tendency to muscle the bar with their arms.

Photographs by Steve Smith/Wheeler Pictures

"Most of our athletes don't really see what they're doing," says Jansen. This is where video digitizing and computer analysis can make a big contribution.

"If you're going to lift 500 pounds over your head, your physics and biomechanical principles better be right," Jansen adds wryly.

The full impact of biomechanical training may not be felt until four or eight years from now. And although scientists are reluctant to take full credit, some startling leaps in the performance levels of a number of athletes have occurred—improvements that may not have come about without the introduction of computer analysis as another element in training. Even as early as last summer there were reports of Gold Medal contenders whose performances, after undergoing computer analysis, had shown outstanding improvements: hammer thrower Dave McKenzie, who had bettered his distance by more than 32 feet in four years; sprinter Calvin Smith; high jumper Louise Ritter; archer Rick McKinney, whose score jumped by an average of 30 points after the computer revealed corrections that could be made in his stance; and horizontal jumpers Carol and Carl Lewis.



**RECORDING FORM**

**In Colorado Springs, race walker Mark Fenton's form is filmed at 500 frames per second as part of the Elite Athlete training program.**

After Carl Lewis's sensational jump of 28 feet 10¼ inches early this year at the indoor Melrose Games, Olympic officials expect him to be an overwhelming favorite to capture gold in L.A. Lewis, his sister Carol, and other long jumpers have been scrutinized in recent months by Dr. James Hay's IBM computers in the Biomechanics Research Laboratory at the University of Iowa, another Elite Athlete Project sponsored by the USOC. "Computer technology is a relatively new element in training," says Dr. Hay. "Until the last couple of years athletes and coaches have had very little if any scientific information or feedback on how they were doing."

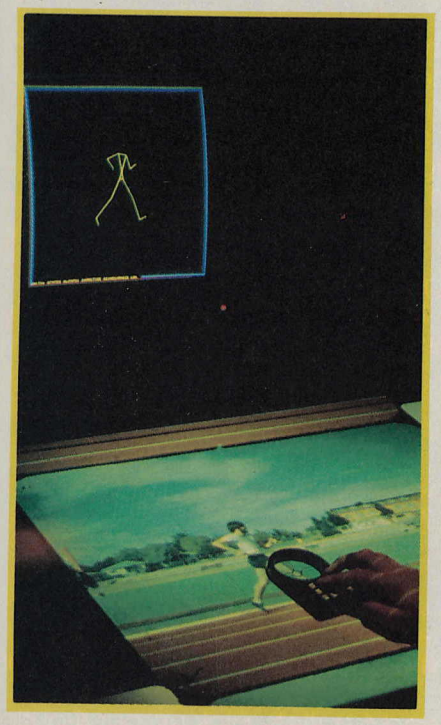
To get that information, athletes are filmed at high speeds in actual competition. That film is then digitized and with the aid of computers used to generate data about their performances. Velocity, angles, and flight times are carefully studied to see which factors might be critical to an athlete's performance. Conclusions and recommendations are then drawn up and given to the athlete's coach, who has the option of implementing those suggestions or not.

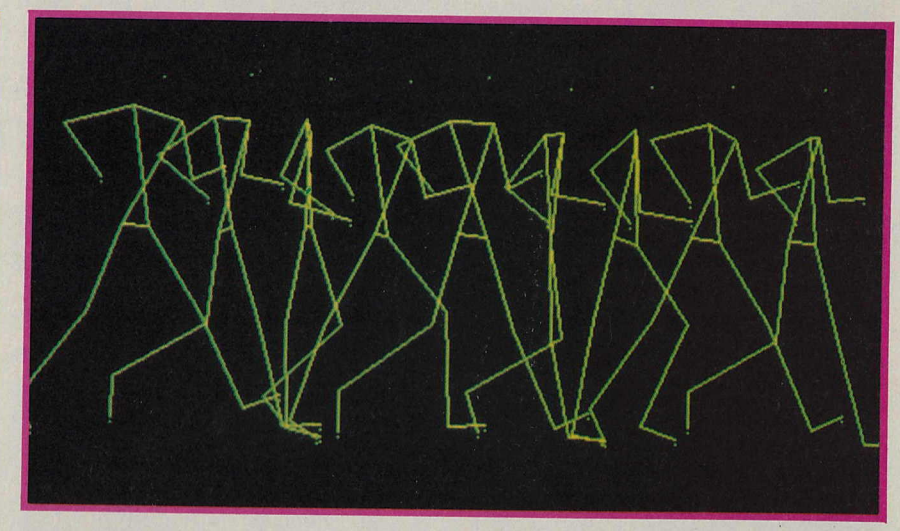
In the case of the long jump—looking at Carl Lewis, for example—Dr. Hay typically begins by shooting the athlete's leap at 100 frames per second. From takeoff to stride length, from flight time to angular momentum generated, all the components of a successful jump are measured. Fed into a computer, the information is analyzed and printed out. A series of graphs, sometimes as many as 50, are also plotted. "These graphs are especially useful because you can find relationships, and with a bit of detective work, spot trends," says Dr. Hay.

### Analyzing the Competition, Too

Filming and analyzing the performances of athletes from other countries may also produce some answers that can be applied to Americans. For example, a number of new things showed up when East German women long jumpers were analyzed in a meet last summer. Although we've started to work with national-level athletes "very late in comparison with the rest of the world," Dr. Hay says, "we have caught up very, very fast."

Another scientist who has been in the forefront of that international game of catchup is Dr. Gideon Ariel, a former Israeli shotputter and discus thrower. Ariel, who has a Ph.D. in computer science, is chairman of the





**ANALYZING FORM**

**Digitized stick figures are projected (above and left) and analyzed with a Data General Eclipse minicomputer (right). Coaches use the information to help athletes improve.**

Olympic Committee's biomechanics and computer science research project; he is also, perhaps, the new science's most visionary advocate. His Coto Research Center in Southern California is, among other things, the home training base for the U.S. women's Olympic volleyball team, one of the USOC's Elite Athlete projects.

Unlike some other scientists, Ariel doesn't equivocate when it comes to making claims for the value of biomechanical training and computer anaylses. The women's volleyball team, he states, was ranked a dismal 54th in the world before it moved to Coto for training and analysis. Now it is among the top three in the world, having at the time of this writing decisively beaten a strong Chinese team by a convincing 3-0 margin.

Using Data General hardware, converting programs to IBM PC XT's, Ariel writes his own software to analyze athletic performances filmed at 300 to 400 frames per second. The film is projected onto a grid dotted with thousands of coordinates which the computer scans, digitizes, and feeds back out as three-dimensional figures on a Megatek graphics terminal. To date, Ariel has worked with more than 300 athletes whose performances, he says, have been markedly improved by applying changes in training and technique suggested by the all-seeing eye of the computer.

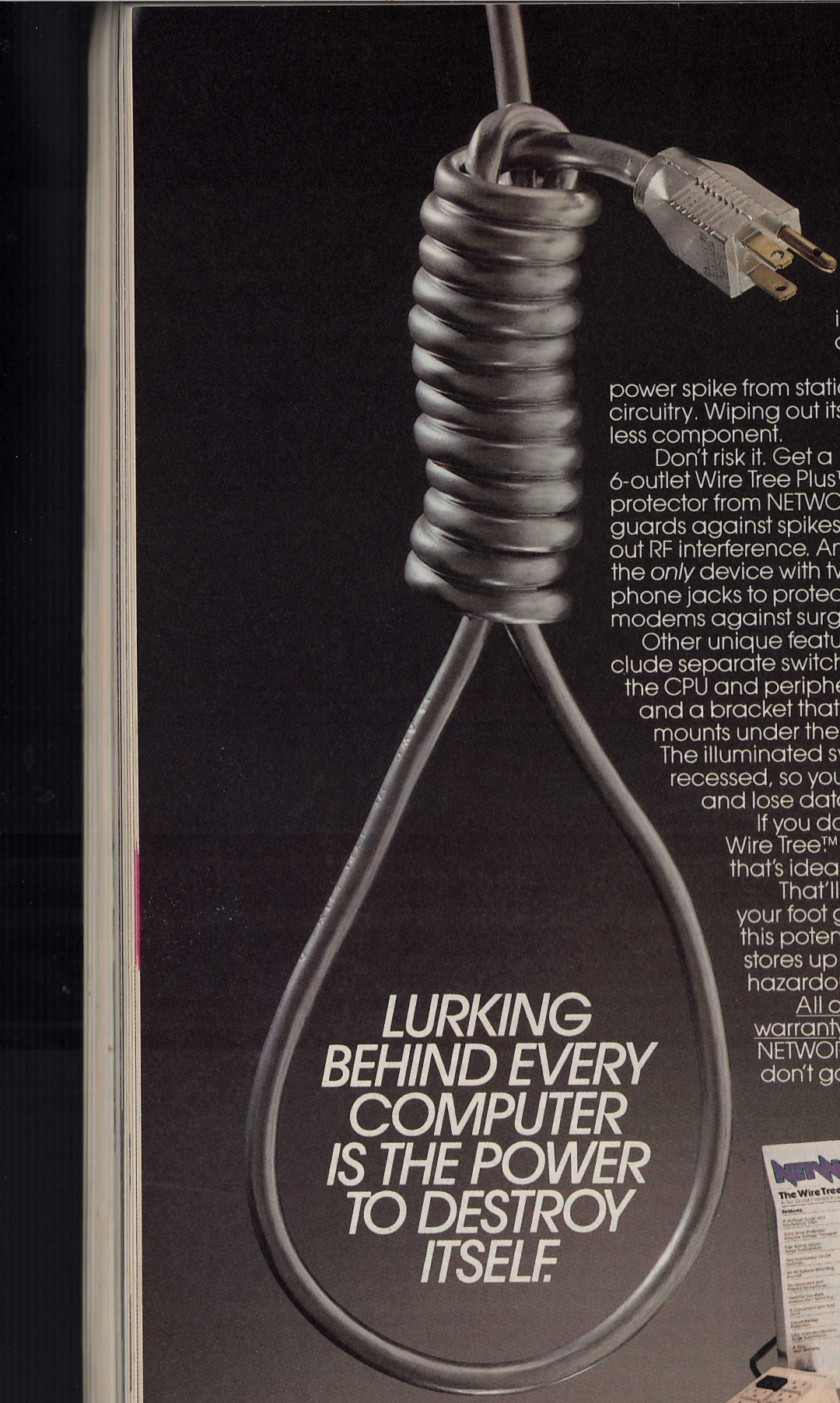
One of his favorites is Al Oerter, the discus thrower who won four Gold Medals and set four distance records, the last coming in the 1968 games at Mexico City when his best toss was 212 feet 6 inches. Now, at age 48, Oerter is going after the gold again, but this time with the advantage of several years of biomechanical training and computer scrutiny. The world mark in his event stands at 240 feet 4 inches and, Ariel claims, Oerter has thrown 240 feet in practice. "He was the best in the world, maybe still is, yet he never achieved his full potential," says Ariel.

### The Big Shape-up to Come

Ariel joins other scientists in predicting that the greatest athletic achievements through biomechanical training lie in the future. The 1984 Summer Games will launch the athletic world on a new course whose end results cannot be perceived yet. The benefits, however, may not just be for those elite athletes competing for gold. According to Ariel, if athletes can improve their performances by 30 to 40 percent, then those same computerized biomechanical training techniques can be applied to the rest of us. "We'll know how to bring people to the best possible shape in the shortest period of time," he says. "Health clubs are already adapting computer methods, whereas six months ago biomechanical training seemed to belong only to a department at MIT."

If that's indeed true, then the Olympics, like NASA's space program, will enable all of us to reap the benefits of the new computer technologies and compete for excellence on our own terms, in our own stadiums. □

Photographs by John Morgan



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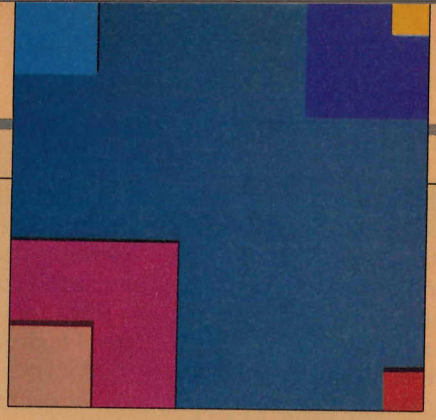
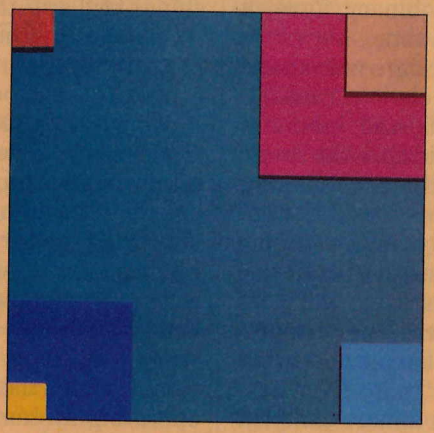
by Rick Cook



# Whenever you use a computer, you are using a program called an

# OPERATING SYSTEM



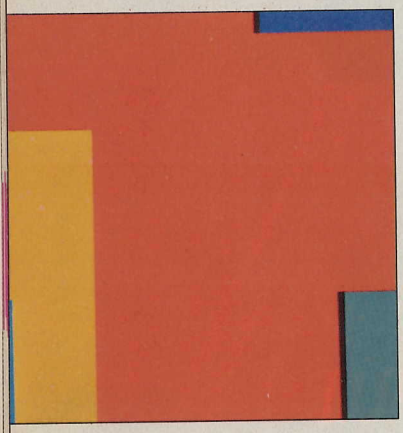
WHETHER you know it or not, the operating system is the first program executed when you turn your computer on and the last program shut down when you turn your computer off. Computer books and magazines tend to wax metaphorical when they describe operating systems and what they do. Operating systems have been called "traffic cops," "majordomos," "virtualized interfaces" or even the "personality" of your computer. They give it a "soul" or handle the "housekeeping." The reason behind these metaphorical outbursts is that an operating system does too many jobs for one simple explanation; it is, in fact, easily the most important software a computer has.

Fundamentally, an operating system is a collection of programs that handles a wide variety of tasks. Specifically, an operating system supervises the processing of applications programs and all input and output. Without an operating system, any computer is only a collection of high-tech gadgetry that does nothing.

Consider what happens when you press a key on the keyboard. By itself, a computer isn't capable of recognizing that a key has been pressed, much less deciding what it means. But the operating system instructs the computer to periodically check to see if a key has been pressed and tells the computer what to do about it. The operating system routine will instruct the machine on how to decode the signal produced by the keypress and, most of the time, tell the computer to display the appropriate character on the video screen.

### PIONEER DAYS

THERE WAS a time, back at the dawn of microcomputing (nearly 10 years ago), when all computers came without operating systems. These early computers were housed in boxes that had rows of switches—built on the same principle as common toggle switches used to turn on and off electric lights and appliances—and light-emitting diodes on them. Those switches were used to enter the data and programs in binary form, a byte at a time.



This design was short-lived, for obvious reasons. Keyboards and monitors were added to the basic boxes with the blinking lights, and mass storage was vastly improved during this period of explosive microcomputer development. Microcomputer programmers quickly learned how to put simple operating systems in read-only memory (ROM). Those ROM systems enabled the computer to read in a more complex operating system from a punched paper tape or an audiocassette. During those early days, programmers made two important discoveries. First, while it may be challenging to write a keyboard decoding routine once, writing one for every applications program becomes a pain in the neck. To write such a routine once and make it part of the operating system is much easier. Second, if many people used the same operating system, programmers could write applications software that would run on a lot of machines without modification. Thus (more or less) the software industry was born.

This idea of portability has evolved, or at least received its widest expression, on microcomputers. In the world of minicomputers and mainframes everyone assumed that the operating system would be customized for a particular make and model of computer. The idea of running the same operating system on a mainframe or minicomputer from IBM and one from Digital Equipment Corporation (DEC), or even on two different models from the same company, was, to say the least, considered farfetched. Yet it happens frequently in the micro world. In fact, we often expect a great deal of compatibility and are mightily disappointed if, say, a DEC Rainbow won't run programs written for an IBM PC.

### PROPRIETARY CLAIMS

OPERATING-SYSTEMS portability is only a recent development in the history of microcomputing, and it is far from universal today. Originally, just about every computer company had its own operating system; when you bought your machine, you were locked into the operating system that came with it.

This wasn't so bad on the inexpensive home computers that had the operating system completely in ROM. These computers typically had limited memory capacity, and having a proprietary operating system for each model meant that it could make the best possible use of that machine's features in the memory available. Since it takes several minutes to load an operating system from tape, and since it would consume as much as half of the computer's memory space, switching operating systems isn't at all popular on those computers. Understandably, then, almost all of these inexpensive machines still use their own special operating systems.

On larger machines, however, this proliferation of proprietary operating systems proved costly. First, of course, is the expense of writing the operating system. A computer company has to invest a lot of programming man-hours into developing a competitive operating system. Moving applications programs over to the proprietary operating systems requires even more expensive programmer time. And because most applications programs were written by companies other than the computer manufacturer, it might be a long time, if ever, before a popular program became available for a particular machine. Yet this situation could be easily remedied on these larger machines—if most of their operating system was stored on a floppy disk. (There is usually only enough ROM to instruct the computer to load in the operating system.)

Clearly, the answer was a portable operating system. The pioneer in this area was Digital Research with its CP/M (Control Program for Microprocessors). CP/M is written to make existing applications programs easy to move to new computers—provided that the new machines conform to certain hardware standards including using the Intel 8080 or 8085 or Zilog Z80 8-bit microprocessor.

Manufacturers could license CP/M from Digital Research for less than they could write their own operating systems, and a lot of them did. Consequently CP/M's widespread use encouraged programmers to write applications programs for it. The availability of a variety of software made CP/M systems popular with buyers, which encouraged even more manufacturers to

Rick Cook is a freelance writer based in Phoenix, Arizona.

hop on the CP/M bandwagon.

But not everyone went to CP/M. Some computers couldn't use it, and some companies already had firmly entrenched proprietary operating systems that were supported with a large number of applications programs. Apple, for instance, had built its computers around the 6502 microprocessor, and a stock Apple couldn't handle CP/M. Although the company offered an adapter card that gave the machine CP/M capability, most Apple software was written in AppleDOS, or later, ProDOS. (DOS, by the way, stands for disk operating system.) Radio Shack's popular Model I and Model III computers couldn't run CP/M because of hardware incompatibility. Both the Model I and the Model III had ROM in the memory locations that CP/M needed for random-access memory (RAM). So Radio Shack stayed with its TRSDOS, which, like AppleDOS, had a broad software base by the time CP/M gained wide acceptance.

**SEVERAL minicomputer operating systems are now running on microcomputers**

### ENTER 16-BIT COMPUTERS

YET CP/M had a particular drawback—its hardware requirements. The new, more powerful 16-bit microprocessors such as the Intel 8088/8086 family couldn't use the old version of CP/M. Instead, new operating systems had to be developed for them.

Naturally, Digital Research developed a 16-bit version of CP/M, called CP/M-86. However, when IBM went shopping for an operating system for its Personal Computer, it chose to go with a system from Microsoft, a company that had been best known for its version of the BASIC language. IBM called the operating system PC-DOS, Microsoft called it MS-DOS, and when the IBM PC became a runaway best-seller, PC-DOS/MS-DOS became established as the most popular operating system for 16-bit microcomputers.

However, just as there had been other operating systems that competed with the original CP/M, MS-DOS has a number of competitors. CP/M-86 is alive and well, for instance. So is another operating system from Digital Research called Concurrent CP/M or Concurrent DOS, which allows several programs to run at once.

Still another operating system that has gained much attention is the p-System from Softech Microsystems. The p-System's major selling point is program portability. Just about any p-System program will run as-is on any p-System machine. The p-System's portability differs from most other operating systems, where the manufacturer typically brings out a slightly different version for each microprocessor. This practice means a person buying a new computer will also have to buy new versions of all his programs.

The new 16-bit microprocessors not only necessitated adaptations of existing operating systems, but also brought about a whole new class of operating systems for the microcomputer world. Because these chips pack the power of a minicomputer some minicomputer operating systems are now running on microcomputers.

The two best-known examples are Unix and Pick. Both are big, multiuser operating systems that have been around for some time on minicomputers. They are more complicated and more powerful than the other operating systems we have discussed. Unix was originally developed on minicomputers at Bell Laboratories. It is used widely in colleges and universities, and most computer science graduates have had at least some exposure to Unix.

Pick is less well known. It grew out of a government information-management project in the 1960s and has been used on minicomputers for about a decade.

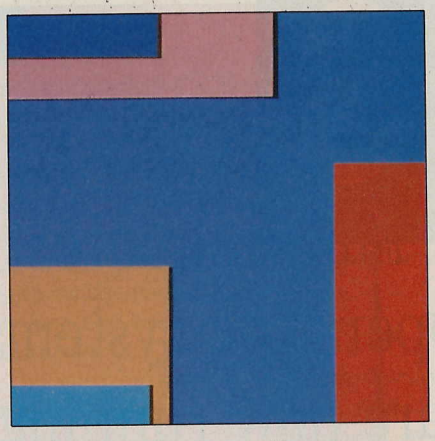
Finally, not everyone decided to use the power of the new microprocessors for minicomputer-like functions. Apple chose instead to use the more powerful Motorola 68000 microprocessor to develop operating systems that are much easier to use. These user-friendly operating systems are used on the Lisa and Macintosh computers. They employ numerous icons, pull-down menus, and a pointing device called a mouse. Although the operating systems used on the Macintosh and Lisa are very complex, they let a beginner learn to use the computer effectively in just a couple of hours.

### LOOKING AT OPERATING SYSTEMS

IN THE articles that follow, we examine eight operating systems or families of operating systems: the CP/M family, MS-DOS, AppleDOS/ProDOS, Unix, Pick, the p-System, TRSDOS, and the Macintosh/Lisa operating system. Since there are about 100 microcomputer operating systems in use today, we had to be somewhat selective. We started by eliminating the operating systems that are primarily non-disk-based. Ultimately, we restricted ourselves to disk-based operating systems designed for general use which are popular or most likely to affect the future of microcomputing. ►

Photographs by Ed Crabtree

# CP/M



CP/M was the first popular nonproprietary operating system, and many of its concepts and features are often copied. Even today, despite the spread of 16-bit computers, CP/M is still the most widely used operating system in the micro world.

Although CP/M dates back to the dawn of microcomputer history, it has been continually upgraded and new versions issued. The most recent, Concurrent DOS (formerly Concurrent CP/M), even lets the user run programs written for other operating systems and provides a number of advanced features.

CP/M was a by-product of the first attempt to offer a high-level language on a microprocessor. In 1973, Intel, which had developed the first microprocessor, wanted to implement a version of PL/1 (a language that combines some of the features of Fortran and COBOL) called PL/M on its new microprocessor chip, the 8080. The job of writing PL/M went to Gary Kildall.

By modern standards, Kildall's development system was pretty crude. He had a very limited amount of random-access memory (RAM) and only one of the first 8-inch floppies produced for microcomputers. Before he could get PL/M running, Kildall found he had to write an operating system to tie his machine together.

Memory was so tight that Kildall wrote an operating system that used only about 4K bytes of RAM. Because he was trying to support a software development project, the system contained the routines that are particularly needed by a programmer. And, because he was a computer scientist, Kildall's operating system was naturally oriented toward the expert user.

When Kildall finished the project, he offered his operating system, which he called CP/M (Control Program for Microprocessors, also called CP/M-80), to Intel. Intel looked at the product, decided there was no market for it, and refused. By this time Kildall was getting requests from other microcomputer hobbyists for copies. In 1975, he set up a company called Digital Research to sell his brainchild.

The market for CP/M boomed, in part because of one of Kildall's innovations. He had separated all the machine-specific parts of the system and lumped them in one module, called the BIOS (basic input-output system). The rest of the system was the same no matter what computer it was running on. This made it easy to modify the system for new machines or new hardware options. A company that decided to offer double-sided floppy disk drives, for example, could simply change one section of the BIOS instead of having to scout through the entire operating system looking for pieces of code that would be affected by the change.

Conceptually, CP/M is more a collection of utility programs than an integrated operating system. In addition to the BIOS—the hardware interface, it consists of a user interface called the Console Command Processor (CCP), and the Basic Disk Operating System (BDOS), which supervises applications program execution and input and output.

Yet one of the most striking things about CP/M is how little it actually does. In version 2.2, for instance, the BDOS performs only 40 functions and 27 of them are related to disk operations. To conserve space, the CCP has only six resident commands: ERA, DIR, REN, SAVE, TYPE, and USER. There are about a dozen other CCP commands stored as utility programs on the disk, and they must be loaded when they are called. Compared to Unix with its more than 200 utility programs, CP/M seems small indeed.

But because those commands and utilities were chosen carefully, CP/M is quite powerful. Although it requires that the programmer know a good deal about what is going on, and both the programmer and the user have to work a little to memorize command syntax, CP/M offers an amazing performance.

CP/M has existed in three major versions: 1.4, 2.2 and 3.0 (or CP/M+). In addition there is a multiuser version called MP/M, a 16-bit version called CP/M-86, and Concurrent DOS, which is an advanced 16-bit version.

Computerists have had a love-hate relationship with CP/M since its beginning. They like the standardization it offers and they appreciate its power, but almost no one claims it is easy for a novice to use. Part of the problem is CP/M's size. An operating system that occupies less than 8K bytes of memory doesn't have room for fail-safe checking routines and elaborate error messages. Furthermore, there isn't a lot of consideration given the poor soul who just wants to get an applications program running. Finally, Digital Research's documentation is notoriously bad. Some in fact claim that it isn't written, it is encrypted.

All of these things have improved with succeeding versions of CP/M. Version 2.2 was easier and friendlier than 1.4; and 3.0, which takes up about 16K bytes of memory, is better yet. The quality of the documentation has also improved and the market for books written about CP/M is thriving. In fact, there are probably 100 books available explaining CP/M and about 15,000 CP/M applications programs that testify to CP/M's success.

The 16-bit version of CP/M, CP/M-86, hasn't been as

CONTINUED ON PAGE 135

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# High-Tech Nomad

## *A portable computer fuels a bicycle odyssey across America*

> "I see it every day—the longing, the envy, the faraway look. It's in the faces of businessmen, sweating under their three-piece suits and regarding me over the remains of expense-account lunches. It's in the faces of newspaper reporters who realize a few minutes into an interview that I am living their dream. It's in faces old and faces young, faces barely tanned from a too-short Florida vacation and faces pallid that turn to catch a quick glimpse as I zip past the office window. It's everywhere, for it's a universal lust—the lust for freedom."

by Steven K. Roberts

Since September of last year, I have lived on a recumbent bicycle—an 8-foot-long, high-tech extravaganza that combines the latest in human-powered vehicle research, portable computers, and solar power technology. It's my home, with the three-bedroom ranch in suburbia now just a memory. But beyond that, it's my office as well; as I pedal a 14,000-mile loop around the United States, I am maintaining a full-time freelance writing profession. Thanks to a carefully integrated quartet of support facilities, I can present the illusion of geographic stability when the need arises—and simultaneously juggle book and article manuscripts while having the adventure of a lifetime.

Those support facilities comprise a widely applicable technological infrastructure for almost any kind of information business—on the road.

Freelance writer Steven K. Roberts tours America on his custom-designed 18-speed recumbent bicycle; he uses a Model 100 portable computer for all his writing. Inset: sending an article via Compuserve.

Photograph ©1983 by Jon Goell; (inset: by Katherine Peden)

**My 8-foot long, 18-speed, custom-built bike was a real traffic-stopper.**

### Telecommuting

There has been a lot of talk in the last decade about the "electronic cottage," or "telecommuting." According to this theory, the availability of personal computers would eliminate the need for people to remain entombed in an office. They can take their work home and commute electronically.

This idea, when put in practice, has its flaws. Working at home can destroy the sense of community that is usually found in the office—and more than one would-be telecommuter has been driven back to the grind by the sheer loneliness of the spare bedroom. Also, the sense of being chained to a desk doesn't necessarily go away just because you happen to own the desk.

But while the world has debated the viability of the electronic cottage, the technology on which it is based has continued to develop. It is becoming clear that one can work *anywhere*, not just at home. That anywhere can include the hotel rooms of a business trip, the cabin of a yacht, a beach, a friend's kitchen table, or a motor home connected by various umbilical cords to a campsite in the woods. It's no longer just a simple choice between office and home.

Steven K. Roberts is the author of *Creative Design for Microcomputers* and *The Complete Guide to Microsystem Management* (both published by Prentice-Hall). His Compuserve ID # is 70007,362.



Photograph by Dan Burden

So let's look at the four essential ingredients of a nomadic business, and then see how they have come together to make my own high-tech adventure possible.

### The Portable Office

Perhaps the most obvious component is the portable computer—in my case, a Radio Shack Model 100. Hot news six months ago, this 4-pound machine is now viewed as a "transition product" that will tide us over until the *really* robust portables start showing up. But even with its limitations, it is at least as much responsible for this trip's success as is my bicycle. How else could I be spending this sunny winter afternoon pattering away on Broward Beach, the prime sunbathing spot for dorm residents at the University of Florida?

Of course there's an obvious problem: file storage. A stand-alone Model 100 would hardly go very far toward maintaining a serious writing business. The memory would fill up halfway through the first feature-length article, and that would be the end of it. There *is* the unaesthetic and crude alternative of audiocassette storage, of course, and a Model 100-sized dual-drive 3½-inch disk system with a CP/M file server is being created for me by Micromax as another solution to the problem. But the easiest method is the daily use of the second component, the Compuserve network.

### The Network

My original reason for getting a Compuserve account (70007,362 here—pleased to meetcha) was simply to communicate with my assistant. This it accomplishes very neatly, but over the months I've been acquiring additional dedicated accounts as well—one for file storage, another for transferring manuscripts, another to support an on-line publishing venture, and a couple more for CB, and tinkering, and E-mail, and the special interest groups, and....

Yes. That's what happens. The network ends up becoming dramatically useful in an enterprise like this, not only for the low-cost business communications that it provides but also for the maintenance of something approaching a stable social life. Even in a nodeless burg in the middle of nowhere, I can sign on to the CB simulator and find friends: "Hey Wordy! Where U B tonite?"

The combination of the portable computer and Compuserve, incidentally, offers occasional entertainment in my encounters with the public. I have become an agent of future shock. In Christiansburg, Ohio, I pulled up to the town's only pay phone and dismounted. The bike gleamed; the Solarex photovoltaics were tilted to face the October sun. I sat crosslegged on the concrete with the Model 100 before me, dialed Compuserve's number, and proceeded to upload a text file to my assistant in Columbus.

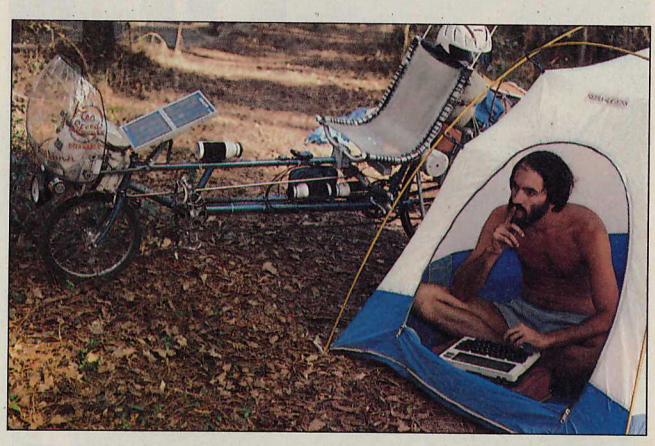
A dusty pickup truck rattled to a stop beside me, and an even dustier farmer squeaked open the door and stepped out. He walked slowly around the bike, quietly assimilating it, all the while thoughtfully chawin' tobacco. Finally he squinted at me and spoke.

"Are yew with NASA?"

### The Home Base

The third component in this nomadic business is a stationary office located in Columbus, Ohio. Should I ever need to present the illusion of stability, there is my established address—no small consideration when pedaling a bicycle around the planet. The office contains a Micromax CP/M system with a USR Password modem, a copier, files, books, and all the clutter one normally expects to find in a writing office. It also contains Kacy, my interface with the universe.

Yes, knitting all this together is a human being, still a necessary ingredient despite the wondrous technology I've already described. Kacy handles mail, deals with the phone, manages the business, edits text, coordinates research, monitors the flow of money, and generally keeps everything under control—something that is otherwise maddeningly difficult to do when traveling. In return for all this, she receives a percentage of the business's income, inducing her to share my own motivation and crack the whip when the distractions of life on the road begin to eclipse work-in-progress.



**Writing an article on the TRS-80 Model 100.**

Photograph by Katherine Peden

Given all this, the basic infrastructure of a business exists. All that remains is for me to generate copy now and again so we can eat.

> "While the world has debated the viability of the electronic cottage, the technology on which it is based has continued to develop."

Doing that is quite straightforward, assuming I can marshal the motivation to work. An article (like this one) begins its life in the Model 100 wherever I happen to be. It's massaged, modified, and manipulated, then shipped off with a flourish via the first available telephone, pay or otherwise. It is transmitted, not directly to Kacy, but into a work area on Compuserve cryptically called "PCP" (for Primary Communication Path).

There it sits until Kacy signs on and finds to her relief that I *have* been working after all. She downloads the article through a USR Password modem into the "base system," then sets to work fine-tuning it with Wordstar.

Sending a story via Compuserve to Columbus, Ohio.

At some point, she deems it shippable and generates a clean manuscript.

From there, it can go one of two ways. More and more publishers welcome electronic submission of manuscripts—it's much less work for everybody involved and reduces the potential for human error. In these cases, she retransmits the text, either through Compuserve or directly into the publisher's own computer system. Some magazines still prefer traditional paper submissions, so for these she simply generates a hard copy and sends it to the appropriate address.

> "I ate an oyster omelette in Ocracoke, North Carolina, met some Compuserve friends in Florida, and fell in love with Key West."

Every now and then, a change in specifications or a particularly awful piece of writing (yes, it can happen) will call for a rewrite. No problem—I just download the piece, edit it, and try again.

If all goes well, the article will eventually generate a bit of money. Meanwhile, of course, I have been spending furiously on the road. This calls for some cash management since we are, in the manner of most small freelance businesses, always performing a financial juggling act. This is another of Kacy's jobs; she does battle while I strategize from a safe distance.

All of this implies considerable ongoing communication between my bicycle-borne office and the one in America's heartland. The daily exchange of STEVE and KACY files in our Compuserve work area is our mainstay—files that are downloaded and deleted immediately after we read them. This is a simple and effective scheme: the disappearance of a file serves as acknowledgment of its receipt, and there is very little overhead (or on-line time) associated with storing and retrieving messages.

We discovered after a few months, however, that a random collection of "do this, do that" messages in the KACY files tends to become confusing. This is understandable, given the deluge of activity that sometimes floods that basement office in Ohio, and a solution was clearly called for. It turned out to be simple. We formulated a file containing a list of tasks to be completed, along with progress reports added by both of us. We manipulate this file with Compuserve's FILGE—a vanilla-flavored line editor—eventually deleting an item completely when it is no longer active.

The combination of STEVE, KACY, DO, and various text files is an effective communication system through which all business matters are transacted: writing projects, new contacts and places to stay, financial matters, and the inevitable red-alerts. Our use of the telephone is minimal, generally occurring only when absolute maximum speed is required.

Personal mail is one class of communication that remains outside this system. Random correspondence can simply be opened and retransmitted electronically, but that would be inappropriate for letters of a more intimate nature. The solution is simple—I request that friends write "personal" on the envelopes of anything intended for my eyes only, and Kacy forwards these items to my current mail stop.

This takes care of the mechanics of day-to-day business on the road. These techniques enable me to appear stable if necessary (a rare requirement) and provide a framework for an active freelancing business.

### Can Anyone Do It?

But how applicable is all this to others? Although few people can pull up roots in favor of a nomadic lifestyle, the combination of the technological infrastructure and these basic techniques can be profoundly liberating for almost anyone in an information profession.

A lot of people share a common problem—the serious disruption of business when, for whatever reason, they travel. This applies not only to full-time nomads like me, but to many others as well:

- the sales person or marketing rep who is on the road frequently or who often attends trade shows. These mobile folks have struggled for years with the problems of communicating with a home base—and they typically have the trunks of their cars crammed with all sorts of office clutter
- business executives who need to travel (or just like an occasional vacation) but find the time away from the office to be troublesome and inhibiting
- those in the obvious information professions (con-



Photographs by Dan Burden

sulting, programming, media, marketing, lecturing and music) who operate primarily from a home base but travel extensively to see clients, perform, or do research

- retirees who are pursuing a lifelong dream of wandering but who need to manage investments, keep track of family businesses, or simply stay in touch with the folks back home
- the true work-at-home crowd, for whom these techniques can be liberating. Before abandoning central Ohio for a nomadic lifestyle, I spent months working in parks, restaurants, and friends' homes—all with the intent of fine-tuning the techniques that would make full-time travel possible.

It seems, then, that a large percentage of the world's business population shares a common set of concerns.

**On the Road**

On the morning of September 28, 1983, I climbed astride a custom recumbent bicycle, performed a few obligatory figure-eights for the TV cameras, and pedaled off to Indianapolis—the first stop on a human-powered journey that is projected to last well over a year.

After a 762-mile shakedown cruise that included Louisville and Cincinnati, I returned to Columbus, spent a week fine-tuning the bike and other equipment, then set out in earnest. Winter's breath was on the back of my neck—twice in Pennsylvania and Maryland I pressed on within 24 hours of a snowfall.

I encountered a band of prison inmates in the Maryland woods, who plied me with pirated Sara Lee pastries from the truck wreck they had been sent to clean up.

**In each new city reporters asked the same old questions.**

Travel has always been a mixture of severe disruption and welcome relief from the daily grind. The costs of attending trade shows and visiting distant clients (or of just taking off for a week) have to include not only the obvious travel and accommodations expenses but also intangibles like the loss of business continuity, missed phone calls, and the vacation attitude of subordinates when the boss is away.

But networks, portables, a base system, and a handful of simple techniques can help you break the chains that have traditionally bound you to your desk. Let's now have a look at my bicycle odyssey for an extreme example of this timely phenomenon.

I stayed at one college after another, sampling dorm life and interviewing professors about their computer-science textbook needs.

I ate an oyster omelette in Ocracoke, North Carolina, almost got a speeding ticket in Georgia, met some Compuserve friends in Florida, and fell in love with Key West—just past the 3000-mile mark.

I stuffed the machine into the forward sail locker of a 36-foot yacht named *Awesome!* and sailed from Key West to Clearwater, then pedaled on. The adventure continues, fueled by the writing income, which would never have materialized were it not for the systems described earlier. The overall journey will describe a

Never having a fixed destination has its rewards.

ragged loop around the United States, very likely followed by a similar tour of Europe.

The bike itself—which I have come to call my *Winnebiko* in honor of its 135-pound load—is something of a tour de force of high-tech self-sufficiency. It can be broken down into four major components: bicycle, electronics package, office, and bedroom.

*Bicycle:* the conveyance upon which everything else depends is a custom-made recumbent bicycle, built to my specifications by Franklin Frames of Columbus, Ohio. Over 8 feet long from fairing to stern, it is a one-of-a-kind machine specifically designed for this trip. With its 18-speed wide-range derailleur, drum brake, underseat steering, and unique frame geometry, this alone is a traffic-stopper.

*Electronics Package:* the first thing one is likely to notice upon peering at the machine is the array of solar panels on their ball-and-socket mount. These generate about 5 watts in full sun and charge the 12-volt, 4-amp-hour nickel-cadmium battery pack that in turn powers everything else. The computer is a very minor load—it will happily run for hours on its internal AA batteries when not plugged into the wall or the bike.

The major loads include a quartz-halogen sealed-beam headlight, a taillight and yellow flasher, a xenon strobe atop the flagpole, a CB radio for emergencies, a pager-type vibration-sensitive security system, a fluorescent tent light, and a yacht horn. The battery, radio, alarm, and charging circuitry are all located in an aluminum enclosure built into the white handlebar bag on the front of the bike. A wiring harness plugs into the side of that, and a pair of miniature panel meters display charge current and battery condition.

*Office:* the major component of the office, of course, is the Model 100, but it is augmented by a microcassette recorder with a remote microphone for dictation on the road, and a small assortment of file folders, stationery, etc. All that fits in a soft briefcase that packs atop the touring gear.

*Bedroom:* finally, there are the components that allow me to be reasonably dry and comfortable wherever I happen to be. Included are a dome tent, stove, the usual camping gear, stereo, rainsuit, and clothes.

The total weight of the system, fully loaded with water bottles full, is approximately 135 pounds. Considered heavy for a touring bike, but light for a mobile business, this actually turns out to be a surprisingly manageable load. Thanks to the recumbent's intrinsic efficiency (and the 21-inch stump-pulling low gear), I haven't had to walk a hill yet.

Needless to say after all this rhapsodizing, the system is working well. Work gets done, and life is a study in sheer exuberance, touched with madness, yet tempered by the realities of business. I lay over here and there to catch up on overdue projects—sometimes for weeks—and then the tires start to itch. The only cure is a good piece of asphalt.

So I say my good-byes, pack the office onto the bike, and pedal off once again, unfettered, seeking adventure, a nomad of the information age. It *is* a liberating technology, and it's getting better all the time. □



Photograph by Dan Burden

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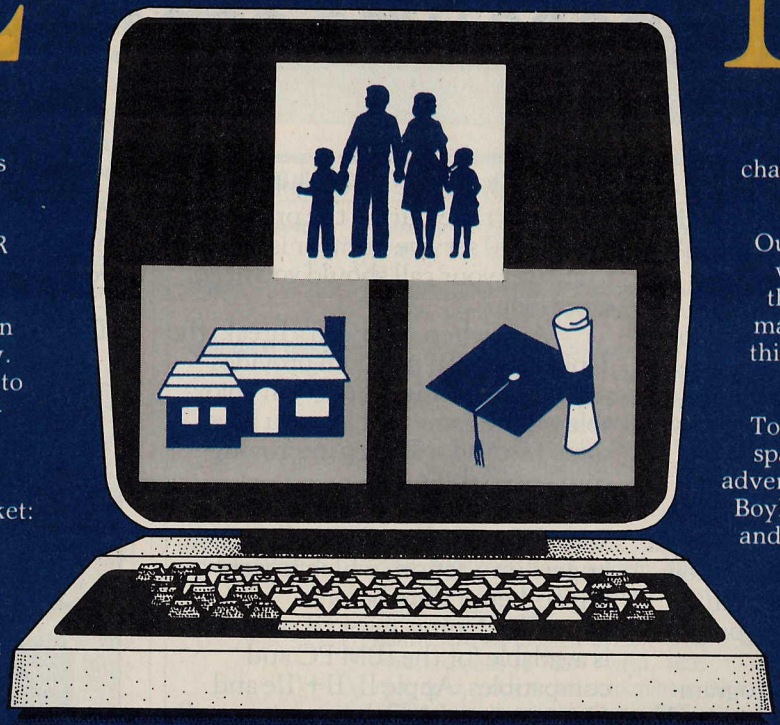

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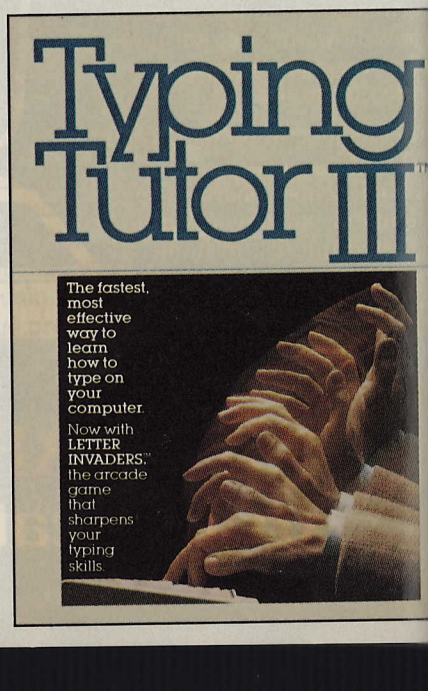
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# The TI Portable Professional

*Texas Instruments combines color and IBM compatibility in a portable package*

by Robb Aley Allan

With all the IBM-compatible portable computers available, one wonders what another such machine could possibly offer. One feature might be an integrated color screen, rather than the green or amber monochrome that is presently the standard. Another innovation could be a full complement of option slots, enough to permit users to customize their portable.

Texas Instruments' new Portable Professional Computer offers just these features. In fact, TI designed its new 8088-based machine to be a functional equivalent of its successful desktop, so TI Professional users can take advantage of the software and hardware they presently have without any modification.

## Professional Examination

The Portable Professional consists of a picnic-box-sized system unit and a separate keyboard that locks onto the front. The system unit measures 19½ by 18 by 8¼ inches and weighs a hefty 34 pounds. Two rubber-coated steel handles are mounted to the side panels and plastic runners along the length of each side permit the closed computer to rest on the floor while protecting its keyboard.

The arrangement of the Portable Professional's keyboard is much like that of its big brother, although the keyboard case has been trimmed.

Robb Aley Allan is a freelance writer based in New York City.

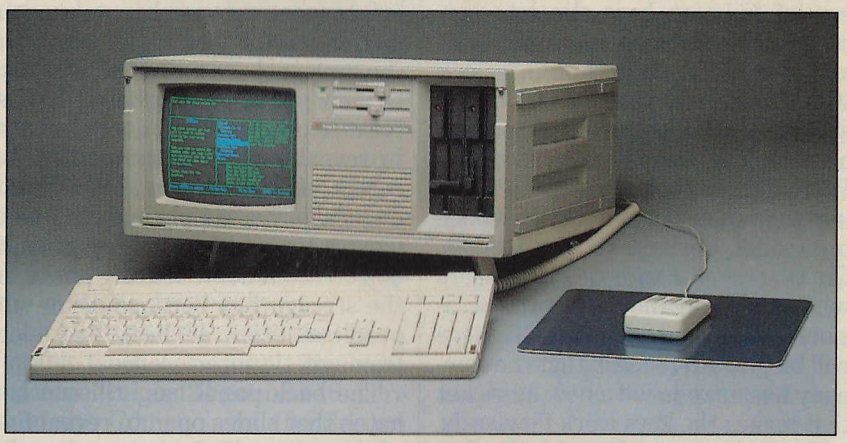
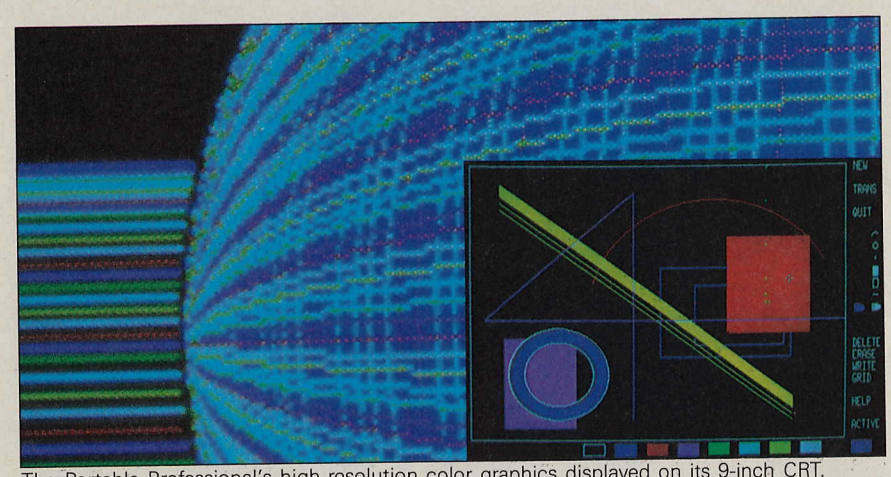


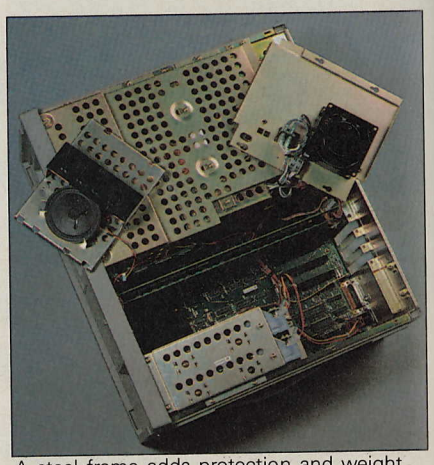
Photo by Ken Skalsky

**AT A GLANCE:** Texas Instruments Portable Professional Computer

| | |
|---|---|
| **Manufacturer:** | Texas Instruments Inc., Data Systems Group, POB 402430, H-642, Dallas, TX 75240, (512) 250-7305 |
| **Uses:** | Personal business and professional computing at the office and at home, using a single portable unit |
| **Standard features:** | NEC 8088 16-bit microprocessor, 64K bytes of RAM, 6 expansion slots, 97-key detachable keyboard, 360K-byte double-sided double-density floppy disk, integrated 9-inch monochrome or 9-inch RGB color monitor, volume control, brightness control, storage box, parallel printer port, text-based CRT controller card, speaker, self-test diagnostics, diagnostics disk |
| **Documentation:** | 160-page User's Manual |
| **Options and accessories:** | 8087 numeric coprocessor, $325; synchronous/asynchronous serial card, $225; 300-baud modem, $295; 300/1200 baud modem, $750; one-plane (two-color) graphics card, $190; three-plane (eight-color) graphics card, $325; 192K-byte RAM card, $450; 256K-byte RAM card (expands to 512K bytes), $795; 256K-byte piggy-back RAM card (expands to 768K bytes), $695; 10-megabyte Winchester hard-disk drive, price to be determined; 360K-byte floppy-disk drive, $400; Cordura traveling case, $100; Omni 800 dot-matrix printers: Model 850, $599; Model 855, $935 |
| **Base list price:** | $2295 with integrated monochrome display and controller; $2865 with integrated RGB color display |
| **Typical system:** | RGB color monitor, 256K-byte RAM, two double-sided 360K-byte floppy-disk drives: $3465 |



The Portable Professional's high-resolution color graphics displayed on its 9-inch CRT.


A steel frame adds protection and weight.

Two one-inch projections above the row of function keys slip into corresponding slots on the main unit, and two metal clips then interlock with similar ones near the disk drives and the CRT. The result is a secure closure. The casing material of the Portable's keyboard seems a little less solid than that used by the desktop model, perhaps to save weight. On the other hand, desktop users who have been annoyed at the occasional stubbornness of the TI keys will be pleased to learn that the company has introduced a new lubricant that makes the keys work flawlessly.

Throughout, the Portable Professional shows attention to detail. For instance, the top hatch that protects the power switch and fan is notched so that it cannot be closed when the power switch is rocked in the "on" position.

Flip-down legs on the keyboard and the system unit allow both pieces to be tilted for easier viewing on a desktop. The keyboard raises 5 degrees, the system unit 10 degrees, so the keyboard slips neatly beneath the raised front of the system unit. TI's designers have included an 8-foot keyboard cord, 2 feet longer than that for the desktop model, which allows a greater range of movement (although they still haven't thought to connect the keyboard to the front of the computer).

The front panel holds a 9-inch diagonal color or monochrome cathode ray tube (CRT) on the left, one or two vertical disk drives on the right, and a center section with air vents and two sliding controls for screen brightness and speaker volume—a nice touch for late night work. On the top panel are two small windows to view power-up diagnostic LEDs. Next to the panel is a door that lifts to reveal a storage component for cables and accessories. Although the internal power supply and CRT electronics are shielded, TI engineers don't recommend leaving disks in the storage box because of the unpredictabilities of heat and electromagnetic interference.

The back panel has still another hatch that slides open to reveal five of the system's six access slots for option cards, two power cord sockets (one to supply the computer itself and one to power an optional stand-alone monitor), and connectors for the keyboard and printer.

## An Inside Look

To open the computer and add or remove any component requires only a #1 Phillips screwdriver. Inside is the Portable Professional's main circuit board, which runs front to rear beneath the disk drives on the right-hand side: it is identical to that in TI's desktop model. To the left of the motherboard is the video display. Surrounding everything is a steel (not aluminum) frame that supports a roof of interlocking perforated metal cages and panels, each carrying another of the computer's components—speaker, fan and power switch, disk drives, storage box, and so forth.

Among the notable features of the main board are the 5-MHz 8088 microprocessor chip, made not by Intel but by NEC; circuitry for two floppy-disk drives; and of course the six option slots, arranged (as in the desktop) in an L shape—five side by side and the sixth in line with the fifth. This unusual layout permits more slots although it forces two option cards to be shorter than the others. Perhaps to enhance the ruggedness of the machine, all chips—including RAM—are soldered rather than socketed, except the system ROM chips and an unfilled socket for an optional 8087 processor.

The fact that the RAM chips are soldered is a clue that TI doesn't intend to upgrade the memory on the main circuit board when 256K-byte integrated chips become available. In part, this is because additional memory can be readily added using a combination of optional 192K- and 256K-byte memory boards; further, designing the main board for higher-density chips would have left no room for the parallel-printer port and floppy-drive circuitry.

TI has found that many plug-in option boards for the IBM will function properly in the Portable Professional; this includes any board that does not directly address the communications ports or graphics memory or that does not rely on the system's clock for refreshing memory on the card.

## Portable Color

TI sells the Portable in two basic versions, monochrome and color,

both with the same 720- by 300-pixel 25-line by 80-character resolution; these cannot be altered. The Portable Professional's monochrome and color CRTs function identically, so a single display card drives both. Even with the small size of the screen, its high resolution makes text and graphics highly legible. The clarity of such features as graph titles and "data-labels" when using 1-2-3 is particularly notable. Produced pixel by pixel as graphics patterns, they are smaller and narrower than standard text characters, yet can be easily read—though they probably could not be made much smaller. And having high-resolution color in a portable is a joy.

**Portable Storage**

There is complete flexibility with respect to mass storage: the basic machine contains a single double-sided "slimline" floppy-disk drive.

The half-height floppy-disk drive, made by Y-E Data in Japan, is problem-free and generally quieter than its larger cousins. Instead of doors the drive is "closed" with a lever-like gate; once a disk is inserted into the recessed front of the drive, it cannot be retrieved until the gate has been shut and reopened. Although mounted vertically, the drive will operate with the computer sitting on the floor on one side (using, of course, an external monitor). Unfortunately, the choice of sides to stand it on appears to be important: disk-reading problems may occur if the drive is uppermost.

Users can later insert a second floppy or a slimline 10-megabyte Winchester hard disk if they like. And because the CONFIG command in TI's version of MS-DOS can recognize "quad-density" floppy drives with 96 tracks per inch instead of the normal 48, owners can pack their systems with enormous storage.

All plug-in option cards for the desktop model will fit the Portable without alteration. However, because the Portable's video display is contained within the system unit, it had to be connected internally. This was accomplished by adding a small jumper wire to the video driver card; older versions of the card without the jumper will not work with the Portable. But as a result, the newer card in the Portable leaves the exterior monitor jacks free and allows two external monitors to be used, monochrome and color.

**Heavy-Duty Traveler**

While no computer can be said to resist much abuse, the Portable Professional seems capable of withstanding a good bit. TI engineers believe that the most vulnerable components (even beyond the optional hard disk) are the floppy-disk drives, and so they have taken particular precautions to ensure that they can withstand the hardships of travel. Nonetheless, care should be taken to secure the system through such measures as inserting cardboard head protectors in the drives. The hard disk comes with software that users should use to retract the read-write heads before packing up the machine for transport.

If the Portable Professional has a notable fault, it is weight. The basic machine weighs 34 pounds—6 more than the Compaq and the Seequa Chameleon, which TI engineers explain is caused by the use of steel rather than plastic or aluminum in the structural framework. TI adds that this "overbuilding" was needed to accommodate the added weight of the color monitor, but it causes the basic monochrome unit as well to be heavier than average. Color adds another 6 pounds, a second floppy drive or a Winchester another 3½ pounds, and pretty soon *your* musculature reaches *its* design limits. The 44 pounds of dead weight—even when lifted by a comfortably padded handle—can't be toted more than a couple blocks.

I found a few other annoying problems. The speaker occasionally emitted a faint buzzing and crackle when using certain applications packages, which might have been caused by electromagnetic interference from the CRT or the power supply. And the Portable is not silent, due to the ever-present sound of the cooling fan.

**The Competition**

Compared to the new IBM PC Portable, the Portable Professional enjoys a number of distinct advantages. TI's machine possesses superior screen resolution and clarity—its text displays are much more readable. Also, the option board for TI's high-resolution bit-mapped graphics mounts on the standard text-based display board in a "piggyback" fashion, eliminating the need to use another expansion slot.

And, of course, TI's keyboard is far and away a simpler keyboard to use. The key mechanisms take advantage of the "Hall Effect" (electromechanical contacts are replaced by devices that rely upon alteration of magnetic fields). As a result, the keys are simpler in design, lighter, and smoother operating than IBM's.

The new version of DOS that has been announced along with the Portable is called 2.1 (slightly more recent than IBM's 2.0) and includes a virtual disk utility. Among the added features is a command called "emulate," which enables The Portable Professional (and desktop model) to run a number of software packages written for the IBM PC.

As far as *IBM-compatible* machines are concerned, the Portable Professional has some clear advantages, despite its added weight. Though not fully compatible with the IBM PC, TI appears to have achieved significant success in its own right and is well along the path to independence. According to analysts at Future Computing, a Richardson, Texas, based market research firm, TI sold more than $90 million worth of desktops in 1983. And TI has made major efforts to encourage third-party support. By February TI had arranged for over 500 software packages to support its Professional computer. TI also offers a world-wide network of company service facilities.

As an integrated machine with excellent color, self-contained mass storage of over 10 megabytes, and straightforward (if not easy) portability, the Portable Professional is a fine choice. □

# TI Add-Ons in the Spotlight

*Four state-of-the-art products that enhance the Professional Computer*

by Michael J. Miller

IBM competitors have to deliver that extra pizzazz to steal the spotlight from the IBM Personal Computer. The Texas Instruments Professional makes its pitch by showing off an array of options designed to bring state-of-the-art technology to the user. From speech recognition to communications software to printers, TI strives to prove that advanced add-on features provide a valid reason for choosing a Professional rather than a Personal Computer.

Not long ago, I had the opportunity to demonstrate these TI products to a friend who stopped by my office. "Watch this," I said. Turning to face my computer, I said, "Computer, dial Dow Jones for me." As the disks whirled and the screen began to flicker, my friend noticed that my hands remained away from the keyboard. "Please tell me," I continued, "what is the current quote for IBM? Execute that." The computer beeped and rapidly displayed the answer. A few more verbal commands produced monthly stock prices for 1983 on the screen and a bewildered expression on my friend's face.

Two Texas Instruments products made that impressive demonstration possible: the Speech Command System, which combines telephone management with the latest in speech recognition technology, and Natural Link, a communications program that lets you replace code-like commands with sentences to get information from the Dow Jones News/Retrieval Service. Finally, computing doesn't have to depend on the dexterity of your fingers on the keyboard.

Michael J. Miller is a West Coast editor of *Popular Computing*.

## Speech Recognition

The Speech Command System is very impressive; your computer recognizes what you say and converts your words into commands for a given program. At $2600 for a plug-in board and several programs, this system might at first appear to be a "techie" luxury. But this powerful option offers us a glimpse of computing in the near future.

The heart of the software is the "transparent keyboard," which lets you give your computer verbal instructions that have the same effect as numerous key presses. Using the system, you first create a "vocabulary" containing up to 50 spoken words or phrases and their alphanumeric equivalents. The system is speaker-dependent, which means that it can recognize only *your* voice saying those phrases. But it tolerates regional accents, so don't worry about trying to sound like a TV anchorperson.

You can create as many of these vocabulary files as you want, limited only by the machine's memory and disk space. And you can chain these files so that a phrase from one file

**TI's new add-ons for its Professional Computer include two software packages, TTY Communications and Natural Link; the Speech Command System, which includes headset, plug-in board, telephone connecting cables, and software; and the Omni 800 Model 855 high-quality impact printer.**

Photograph by Mike Carr

cues another file. Thus, you could have one set of phrases that you use while in the command level of the operating system and have a second or third set that becomes active when you invoke a particular application. Theoretically, you can use as many as nine of these vocabularies at one time, yielding up to 450 phrases. But, in practice, memory limitations force you to use either very small vocabularies or only two or three large vocabularies.

When you use the transparent keyboard, the Speech Command System acts as though it is part of the computer's operating system—you use any program just as you would normally. But when you speak a word or phrase the system understands, it automatically enters the alphanumeric equivalent of what you said. When you run a word processing package, you could just say "delete line" and the speech system will give the word processor the proper commands to do that.

For most users, the system simplifies repetitious operations. Instead of typing in a long string of commands, you just speak a single word. For instance, in my first example, all I had to say was "Dow Jones" because I had programmed the system to enter the name of the program; give that program my name, password, and the drive to store data on; and switch to the vocabulary for that program.

I tried out the transparent keyboard feature with several different programs, including Lotus 1-2-3, Wordstar, Peachtext, and Natural Link. Generally, it worked well. The system understands my commands about 90 to 95 percent of the time. When it misses a command the first time, it usually recognizes it if I repeat it. Occasionally, the system misinterprets background noises in my office as valid commands—a problem when the phone rings or when someone drops by to chat. But overall, the performance exceeds any other speech recognition system I've used.

### TI, Phone Home

The TI designers have included several other features in the Speech Command System. With the telephone management software, you can say, "TI, phone home," and the machine will do just that. E. T. should have had it so easy.

You can also use the system as a telephone answering device. The system stores your greeting and any incoming messages on disk, up to 16 minutes on a floppy disk or 8 hours on a 10-megabyte hard disk. When playing back messages, you can adjust their speed without changing their tone and store them for later recall. You can also get your messages by dialing a code from any Touch-Tone phone.

Technically, phone recording is quite a feat, as the system must convert speech to digital form for storage and back again. Practically, however, it is a $5000 computer package that does the job of a $300 answering machine. And its messages are not as clear. Also, the system currently can record only voice messages, so you have to make a choice if you also have a modem with auto-answering capability. If you could intermix voice and data communications, these telephone management features might be more useful.

In the future, we can expect TI to iron out some of the problems, such as the misinterpretation of occasional extraneous sounds. And advancing technology should allow switching between voice and data. I'm impressed by the quality of the Speech Command System, though I question its useful return for its $2600 price tag.

### Natural Link

Anytime you attempt to use a communications service, learning the proper commands emerges as your biggest problem; every service has a unique command structure. TI, with its Natural Link communica-

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## AT A GLANCE: TI Add-Ons

**Manufacturer:** Texas Instruments Data Systems Group, POB 402430, H-678, Dallas, TX 75240, (512) 250-7305; (800) 527-3500

| | |
|---|---|
| **Name:** | Speech Command System |
| **Type:** | Speech recognition system |
| **Features:** | Plug-in board; headset; telephone connection cables; transparent keyboard, integrated phone pad, answering machine, calendar, dictating machine and diagnostic software. |
| **Price:** | $2600 |
| **System Requirements:** | TI Professional (or Portable Professional); 256K bytes of RAM; two floppy-disk drives or one floppy-disk drive and a hard disk; MS-DOS operating system |
| **Documentation:** | Hardware installation manual; detailed software user's guide |
| **Audience:** | Professionals who want an easy way to communicate with their computers; handicapped individuals; industrial applications |

**Name:** TTY Communications

**Type**
Communications program

**Price**
$60

**System Requirements**
TI Professional (or Portable Professional); one floppy disk; modem

**Documentation**
User's manual

**Audience**
TI Professional users who want to access other computers, outside services

**Name:** Natural Link

**Type**
Natural language communications program

**Price**
$150

**System Requirements**
TI Professional (or Portable Professional); two floppy-disk drives or one floppy and one hard disk; 256K bytes of RAM; modem; Dow Jones News/Retrieval password; MS-DOS operating system; telephone line and jack

**Documentation**
User's manual

**Audience**
Professionals and managers; stock market investors; etc.

| | |
|---|---|
| **Name:** | Omni 800 Model 855 printer |
| **Features:** | 150 cps draft-quality; 35 cps letter-quality; user-selectable type fonts; parallel or serial connections |
| **Price:** | $935 (friction feed); $995 (tractor feed) |
| **Options:** | Additional type font cartridges, $40 each |
| **Documentation:** | Operator's manual, technical reference manual |
| **Audience:** | Users of any personal computer with standard parallel or serial ports |

tions program, offers a solution for those who use the Dow Jones News/Retrieval Service, an on-line database with news and current stock information. You formulate questions in normal English, and Natural Link converts those "natural language" inquiries into commands recognized by the database service.

Natural Link divides the screen into several windows, each containing parts of an acceptable question—verbs, subjects, short phrases, and so forth. You select the beginning of a question from a short list in the first window. The program then leads you from one window to another until you complete the question—a sort of progressive multiple-choice exam. Within each window, you either use the cursor keys to scroll through a list or type the first few letters of your selection, then you hit the enter key.

Your question, produced in stages, might look like this: "What were the stock prices /for Bethlehem Steel /for each quarter /in 1982?" The command translation ";BS 82 Q" may be shorter but far more cryptic and much more difficult to remember.

With your question composed, you again hit the enter key, and the system dials the Dow Jones service, submits the question, and then displays the results. You can store these results on disk or discard them and return to the windows to compose another question. The system also allows you to enter the "Dow Jones mode," which lets you use the service's own command syntax.

The program contains a predefined list of firms, Dow Jones symbols for those firms, and stock exchange information (which is not displayed, however). If you know the stock symbol of a particular company and the exchange it is traded on, you can easily add it to the existing list or create another list.

The simplicity of the initial configuration is characteristic of the program's easy use—you just provide your name, the local-access telephone number, procedure, and account number, and a file is created under your name. If privacy is a concern, you can give the file a password so only you can use it. Each time you start the program, just enter your name, password, and the disk the information is to be stored on. The program automatically dials the service and logs on.

TI has revealed plans for several other natural-language-based systems—good news because such systems really do make computers easier to use. Natural Link is the simplest, easiest-to-use communications package I've seen. Anyone could learn to use it in just a few minutes. If you follow stock prices, you will probably find this $150 program (which includes an hour's use time on the Dow Jones system) a good investment.

### Communications

I wish "simplest, easiest-to-use" also described TI's general communications package, TTY Communications. The designers wanted a system that would communicate with almost any other personal computer or available service. They succeeded —perhaps too well.

To use TTY Communications, you create a configuration file for each communication service, such as Telenet or Tymnet. The setup procedure takes you through several menus of communications options. Each menu lists the available choices, and you highlight your choice by moving the cursor and hitting the return key to make a selection. So far, so good.

But look at your choices. Do you want to send one or two stop bits? Should parity be odd, even, mark, space, or none? Should busy waiting be DC1-DC3, Reverse Channel, or none? And so on for 29 questions, which may leave you thinking that running a computer is a mystic art.

Don't blame TI for all of this; the lack of standardization in the communications field creates the problem. But TI could have at least provided some sample setups for common services, either on disk or in the manual—a step that TI says it will take in future versions. Meanwhile, confusing instructions compound your frustration. For example, the program refers to DC1-DC3 protocols, but the manual doesn't make clear that most communication services call the same protocols XON/XOFF.

TTY Communications gave me an in-depth look at the art of telecommunication—perhaps more than I wanted. When I use the program's file-sending routines to send a file to The Source via Telenet at 300 baud, I invariably lose some characters. The same process via Tymnet works fine. I couldn't find the problem; neither could the TI designers I contacted.

Otherwise, this package works well, once you complete the setup. You can send and receive files, check the status of the system, and so forth just by pressing a few function keys. My setup for Tymnet performs wonderfully. Flexible programs do pay off if you're prepared to invest considerable effort.

### Printers

To complement its computers, TI offers a line of dot-matrix printers with nice features. The printers allow both standard parallel and serial connections, making the printers compatible with nearly any popular computer.

I tried TI's Omni 800 Model 855, which the firm calls a "dual-mode printer," designed to handle both data-processing and word-processing applications. In draft mode, you get standard dot-matrix output, with letters formed on a 9- by 9-dot matrix at 150 characters per second (cps). The letter-quality mode provides higher-quality letters at a slower speed—35 cps on a 32- by 18-dot matrix.

Generally, most letter-quality output I've seen from dot printers leaves a lot to be desired. It's clearer than standard dot-matrix printing, but falls far short of the output from a daisy-wheel or thimble printer. With the 855's letter-quality mode, you can distinguish its dot matrix if you look closely. But the type quality of the 855 is acceptable; the characters are clear, well formed, and easy to read.

The 855 also delivers another useful feature—the capability to switch type fonts. Most printers let you use only one font at a time. The 855 will hold three cartridge fonts in special slots in the front of the printer. Each font contains both draft- and letter-quality versions in pica, elite, and compressed character spacing; you switch from one to another simply by pressing a touch panel on top of the machine. TI offers seven fonts at $40 each.

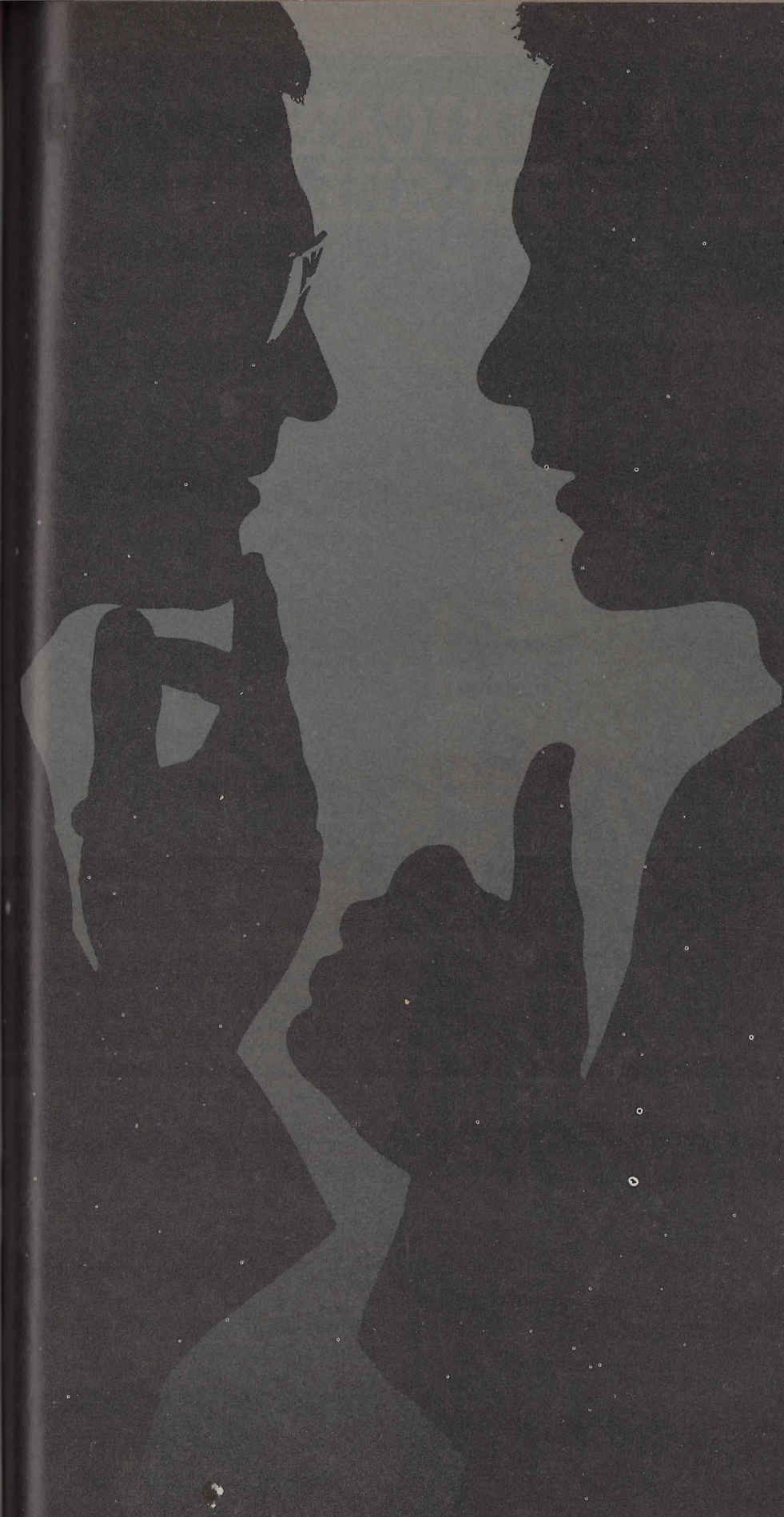
Both standard friction feed and tractor feed are available for the 855. The standard friction feed works fine for single sheets of paper, but if you like the convenience of fanfold paper, get the optional tractor feed. TI's paper-feed mechanism is unlike that of many other printers in that paper passes through the tractor feed before it is printed. This lets you tear off a sheet after it is printed without advancing an extra page. (If paper costs skyrocket, your wallet may benefit from this design.) The printer's 11-inch-wide carriage makes it suitable for printing on standard 8½- by 11-inch paper with tear-off edges.

To make the printer easy to use, TI put the various settings in a lighted touch panel on top of the machine. Lights indicate draft- or letter-quality; the number of characters per inch; 3, 4, 6, or 8 lines per inch; and whether the printer is online. Just by touching the appropriate panel, you can change the settings, switch fonts, or advance the paper by a line or a page.

The printer also supports many common features, including compressed printing, superscripts and subscripts, double-strike, and underlines. Graphs are printed with 144 dots per inch, which yields good-quality reproduction.

The printer measures 16 by 13 inches and weighs 15 pounds. Compared to most dot-matrix or daisy-wheel printers, it is fairly quiet at 62 decibels. It also supports standard industry escape codes, making it compatible with most popular application programs, such as word processing. It uses Epson-compatible codes for dot-matrix printing or Qume- and Diablo-compatible codes for letter-quality printing.

Add-ons such as the Speech Command System, Natural Link, TTY Communications, and the Model 855 printer demonstrate Texas Instruments' intention to give TI Professional users more options than are available for other computer systems. Although the technology in some of these options has not been perfected, these products represent the state of the art in voice recognition, natural language, and impact printing technologies. In today's market, many vendors seem content just to follow the lead of others. In these areas, at least, TI is taking center stage. □



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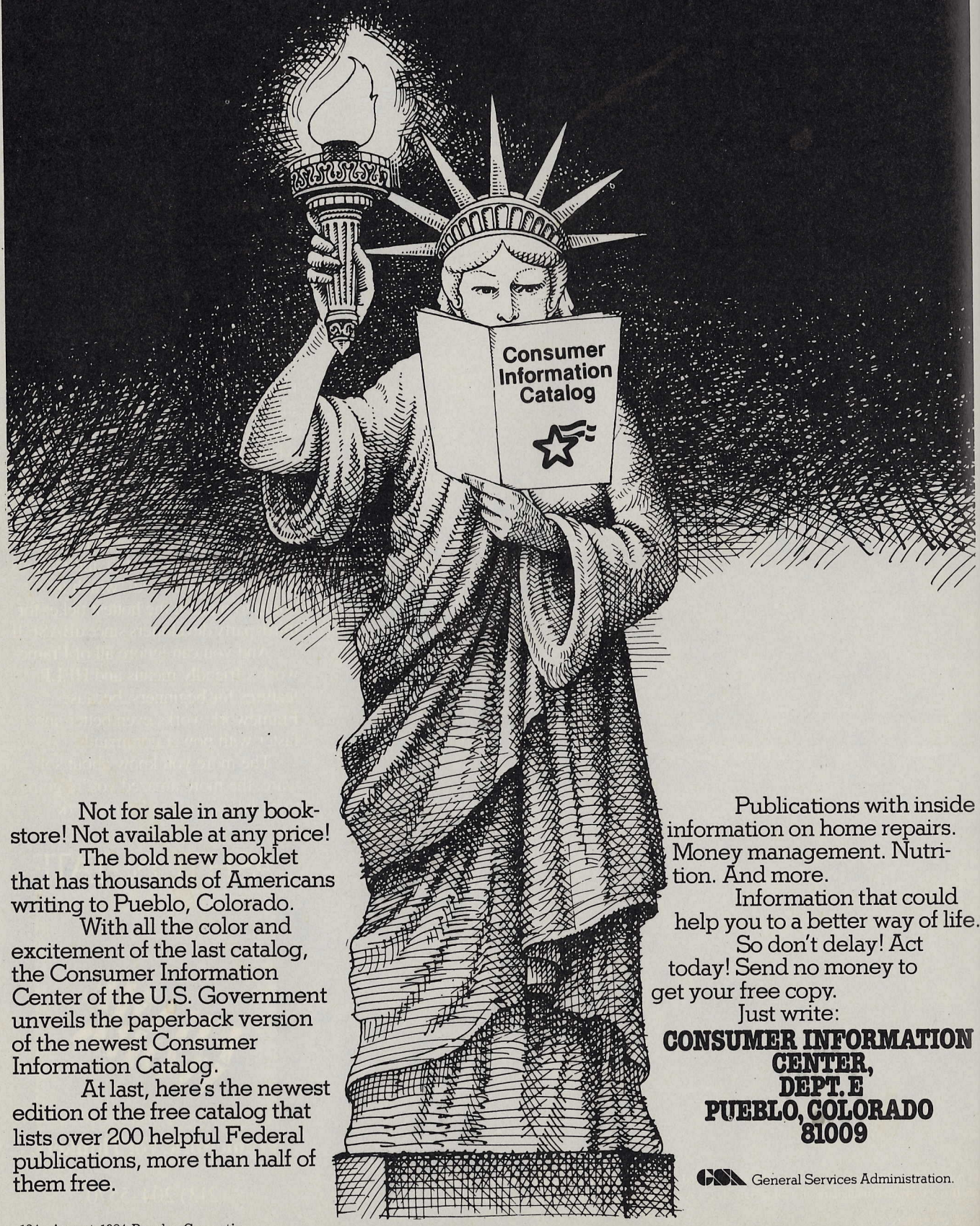


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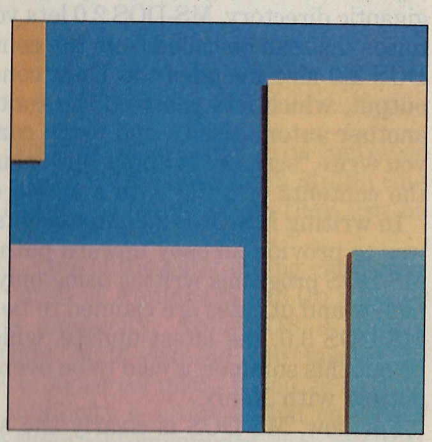
CONTINUED FROM PAGE 114

successful. CP/M-86 is running a distant second to MS-DOS in the 16-bit sweepstakes and as a result has fewer applications programs written for it. Recently, however, Digital Research announced a product that may turn the game around. Concurrent DOS is an advanced operating system that offers windows, the ability to run several programs at once, and the ability to run programs written for MS-DOS and the 8-bit version of CP/M as well as CP/M-86. Reportedly, Digital Research is working on a version of Concurrent DOS which will also run Unix programs.

One of the basic paradoxes of operating systems is that no one but the most crazed software hacker wants them. What the rest of us want are applications programs, and we put up with the operating system to get the applications. A "one-size-fits-all" operating system would be a blessing for users because they would have much more freedom of choice in buying applications software. It would also nullify the advantage that goes to the company with the most popular operating system.

Although Concurrent DOS is exciting, there is a fundamental limit facing the CP/M family. The systems are highly processor-dependent. Originally, CP/M worked only on 8-bit 8080/8085 or Z80 microprocessors; likewise, CP/M-86 and Concurrent DOS are limited to the 16-bit 8088/8086 family of processors. There is a version for the Motorola 68000, but it hasn't proven very popular. New microprocessors appearing from other companies could diminish the CP/M family's popularity. But no matter what new rivals it may encounter, CP/M in its various guises is likely to be with us for a long time.

# MS-DOS



MS-DOS is to 16-bit microcomputers what CP/M-80 is for the 8-bit microcomputers—a de facto standard operating system. More 16-bit computers offer MS-DOS as their operating system than any other system, and the amount of software for MS-DOS machines is beginning to rival what is available for CP/M.

MS-DOS was an outgrowth of CP/M, and conceptually at least, the systems have many similarities. However Microsoft, the company that markets MS-DOS, has begun adding Unix-like features to the system with the avowed intention of making later versions compatible with Xenix, Microsoft's implementation of Unix.

Although MS-DOS stands for Microsoft DOS, the system actually got its start from a small hardware company called Seattle Computer Products. In November 1979, Seattle Computer developed an 8086 processor board for S-100 computers and needed an operating system for it. Digital Research was promising a version of CP/M, but the project was delayed. So in April 1980, Seattle Computer decided to develop a stopgap operating system. Since it was assumed that most users would want to convert to CP/M-86 when it became available, the company was careful to keep as much compatibility with CP/M as possible.

The new operating system took all of two months of programming time to develop and was dubbed QDOS, for Quick and Dirty Operating System. The first copies were packaged and shipped in August 1980.

At the end of the year, Seattle Computer provided a refined version of the system to Microsoft, a company previously better known for its BASIC than its operating system. In July 1981, Microsoft bought the system outright. Microsoft did some work on it, renamed it MS-DOS and licensed it to, among others, IBM. IBM offered MS-DOS (christened PC-DOS) as the standard operating system on its Personal Computer, and when sales of the PC took off, so did MS-DOS.

The close relationship between MS-DOS and CP/M is obvious. Even the command prompt (A>) is the same on both systems. The commands are much the same, and the systems have the same general "feel." Anyone who is familiar with CP/M has little trouble learning MS-DOS.

However MS-DOS is not a carbon copy of CP/M. Where they could, the system's developers improved on the CP/M method of doing things. Since CP/M was tightly constrained by a small amount of memory when it was written, there was a lot of room for improvement.

For one thing, the file handling in MS-DOS is different. In MS-DOS, a copy of the disk's File Allocation Table (FAT) stays in RAM at all times. (The FAT tells the machine where to find the disk sectors containing a file.) This means that the computer can find information stored on disk quickly.

MS-DOS also breaks disk files into larger chunks. Although this means that some space inside its files is wasted, it allows faster disk access.

The most recent version of MS-DOS, Version 2, also features installable device drivers. Instead of having a monolithic BIOS (basic input-out system) like CP/M, MS-DOS 2.0 has separate modules inside the BIOS for each device. This means that the individual device drivers can be customized for whatever disks or other hardware a user wants to add to the system. Installable device drivers are a godsend to someone adding a hard disk to a system or to a software house that wants to sell a hard-disk version of a program.

MS-DOS 2.0 also includes several other features to make life easy for hard-disk users. One of them is a hierarchical file structure, à la Unix. Rather than having files for 10 megabytes of programs and data in one gigantic directory, MS-DOS 2.0 lets you create subdirectories that can be called from the central directory. MS-DOS 2.0 also includes the Unix concept of redirected output, which lets you feed the contents of one file to another automatically, and batch commands, which let you write "scripts" to apply several utility programs to the contents of a file with a single command.

In writing MS-DOS 2.0, Microsoft's avowed intention was to provide an easy upward path to Xenix. In fact, MS-DOS programs written using only MS-DOS 2.0 commands and utilities are claimed to be Xenix compatible. MS-DOS 3.0, the latest update, which is scheduled to be out this summer, is said to be even more closely compatible with Xenix.

For now, MS-DOS is clearly the standard for 16-bit operating systems. There are over 100 computers using it, and the number of applications grows daily. In power and ease of use it represents a considerable improvement over the 8-bit versions of CP/M. The commands are somewhat more logical and straightforward, and the error handling is usually better. The quality of the documentation varies with each implementation, but like CP/M, there are a lot of books on the market to explain it better.

All these advantages are relative, however. Although MS-DOS is easier to use, it is still not a particularly easy system for a novice. It takes a goodly amount of familiarity with the system before you can realize the full power of MS-DOS.

Like CP/M, MS-DOS is not an "invisible" operating system, and most users have to deal with the command level of the operating system to instruct it for many necessary tasks. Also like CP/M, it is oriented toward the needs of the computer and not the needs of the computer user; the user must know the commands and how to apply them. This is in contrast to the approach of the Macintosh/Lisa systems, where the system accommodates itself to the user, or Pick or Unix, where the casual user can be protected from the command level of the operating system by using menus.

MS-DOS is also hardware dependent. It is designed to run on the 16-bit 8088/8086 family of microprocessors and is not well adapted for machines based on other microprocessors. This is one reason that MS-DOS's dominance hasn't extended to the computers based on the Motorola 68000 or other advanced microprocessor families. Those computers tend to offer Unix, Pick, the p-System, or some other operating system that is not

## APPLE

AppleDOS 3.3 is the standard disk operating system for the Apple II and its family. ProDOS is an updated expanded version that works with Apple's hard disk. Neither is spectacular in the way the Macintosh's operating system is, but both do their job in a straightforward manner.

AppleDOS originated when Apple introduced floppy disks for its computer. Since the Apple was built around the 6502 microprocessor, CP/M (based on the Intel 8080 or Zilog Z80 chip) was out. So the company brought out AppleDOS in 1978 as a simple, rudimentary disk operating system.

Although AppleDOS wasn't fancy, hundreds of thousands of Apple owners used it happily for years. However when hard disks became available for Apples, AppleDOS showed signs of strain. It had been designed for single-sided, single-density floppy disks, and AppleDOS really wasn't capable of organizing the volume of information stored on a hard disk.

Apple's answer to the problem was ProDOS, an operating system featuring a better directory structure, faster disk input and output, and a host of other features not available on AppleDOS. Apple says that ProDOS is not a replacement for AppleDOS and that the company plans to support both operating systems.

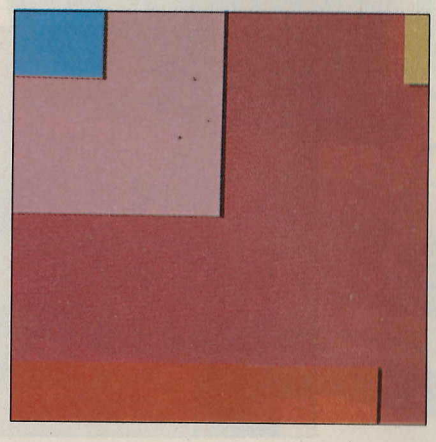
AppleDOS is a "basic" operating system in both senses of the word. Apple chose to tightly integrate its operating system with its version of the BASIC computer language. The result is that AppleDOS works with Apple BASIC (both Integer and Applesoft) very closely. To initialize (format) a disk under AppleDOS, for instance, you must have a BASIC program in memory. The BASIC also controls devices connected to the expansion slots with the commands IN# and PR#. These are normally jobs that would be handled by the operating system.

Like Radio Shack's TRSDOS, AppleDOS was designed for hobbyists, not computer scientists. It is a very

tied to a specific hardware family. Microsoft doesn't see this as a problem and assumes that the users of the bigger, more powerful machines will want a more powerful operating system, such as Xenix (although the fact that they are claiming Xenix compatibility for MS-DOS 3.0 indicates a competitive interest in that market).

MS-DOS is so firmly established, though, that even the purveyors of so-called advanced operating systems are either offering ways to run MS-DOS applications on their systems or busy figuring out how to do it.

# DOS/PRO DOS



simple operating system with a minimum of utilities. It is, however, easy to learn and fairly easy to use. In some cases, BASIC commands take the place of operating system utilities. AppleDOS has its peculiarities, some of which approach the status of bugs, but by and large it serves nicely for what it was designed for—a home or hobby system.

Although AppleDOS serves well enough on a machine with one or two floppies, it strains its limits when used with a hard disk. To use AppleDOS 3.3 with a hard disk, you have to partition the disk into "logical" floppy disks. The system then treats your 5-megabyte hard disk like 40 or 50 floppies. This works, but it is unwieldy. Among other things, it limits the size of files on the hard disk, and it leaves wasted space scattered all over the disk.

A related problem occurs when your disk is nearly full. AppleDOS provides only a single directory that can be at the most two screens long. If your files tend to be short, you can fill up the directory before the disk.

ProDOS avoids both of these problems. ProDOS can handle up to 32 megabytes of disk storage as a single logical unit. It also allows hierarchical directories—meaning you can have a master directory that refers to subdirectories for each group of files. ProDOS also lets you establish pathways that automatically take you where you want to go in the directory hierarchy.

In addition, ProDOS cleans up some other features of AppleDOS. For instance, it speeds up disk access by about 8 times. It also allows you to use Apple's 64K-byte 80-column card as a virtual disk for even more speed.

ProDOS is not just an updated version of AppleDOS. Most of the commands are the same, but the file structures are different. Although it cannot read AppleDOS files directly, ProDOS comes with a utility that lets you convert AppleDOS files to ProDOS. However, the utility works only on the newer, version 3.3 files. The older version 3.2 files have to be converted to 3.3 with AppleDOS's Muffin conversion utility before they can be converted to ProDOS.

One of the outstanding characteristics of AppleDOS and (to a lesser extent) ProDOS is simplicity. AppleDOS is simple enough that a bright eight-year-old can master it. Although ProDOS is more complex, it too, is easy to master. However, simplicity is a virtue that cuts both ways. Compared to their contemporaries, such as CP/M or MS-DOS, both AppleDOS and ProDOS are limited in what they can do.

There are some quirks, especially in AppleDOS, that can trip the unwary. For example, it is possible to give an already existing name to a new file. The system doesn't warn you, but when you write to your "new" file, you wipe out what was previously stored under that name.

One pet peeve is the way AppleDOS handles disk-drive numbering. In AppleDOS, your most recently used drive is the disk accessed unless you specify otherwise. On a two-disk system this method can cause a great deal of unnecessary confusion.

In the case of ProDOS, the biggest problem is likely to be that it isn't fully compatible with AppleDOS. Some programs are not going to work even after they have been converted. Programs that call operating system functions by their ROM address, or ones that do clever tricks with "unoccupied" bits of RAM are particular candidates for trouble.

Since AppleDOS has been a stable product for some time, a good many programs have been designed to accommodate these operating-system peculiarities. That means that users with a collection of such programs may be forced to stick with AppleDOS whether they like it or not.

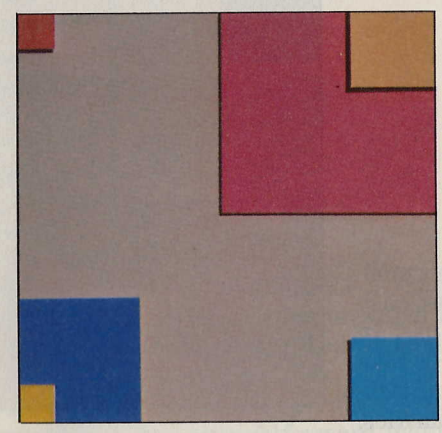
One feature of ProDOS which will undoubtedly frus-

trate a number of people is its incompatibility with some of the higher-capacity disk drives sold for the Apple by third parties. Generally speaking, look-alike drives or drives that use the Apple controller card can handle ProDOS with no trouble, but the ones that require their own controller cards or which offer extra storage may not. Several of the manufacturers of high-capacity drives say they intend to offer software patches so ProDOS will work with their systems.

On the positive side, ProDOS has a command that automatically checks the contents of the slots and tells you what cards are in which slots. ProDOS also supports installable device drivers—short programs that let you hook peripherals to the operating system with a minimum of modification to the operating system. While ProDOS is not the most advanced operating system around, it is unquestionably modern.

Good thing, too, because Apple seems to be committed to perpetuating the Apple II family, as the recent introduction of the Apple IIc has demonstrated. As long as people keep buying and using Apple IIs—and according to Apple's latest quarterly report, the machine is selling well—AppleDOS and ProDOS will have a place in the operating-system mainstream.

# UNIX



With the breakup of the Bell System this year, AT&T has started marketing Unix Version V agressively. Many analysts and manufacturers predict that Unix will be the standard operating system on microcomputers (at least the larger ones) in the years to come.

As a standard operating system, Unix has several things going for it. Most important, Unix is easy to move to new computers. Unlike CP/M or MS-DOS, Unix is written in a high-level language and not built around a single family of microprocessors. Computers ranging from micros to mainframes can run the system with ease, and Unix can be implemented on a new computer in only a matter of weeks. In a world where a new brand of computer appears every week, a new chip every month, and a new family of superchips every couple of years, that kind of portability is indeed an asset.

Unix offers many features, too. Because it is multitasking, a user can do several jobs at one time from the same terminal. And Unix is attractive to software developers in that it contains more than 200 utility programs that perform useful programming tasks. For instance, there are eight utilities for comparing the contents of files. They tell the programmer where two files differ, what needs to be done to make them identical, and what lines are common to both. This richness extends to nearly every conceivable job performed by the operating system. If you need a programming utility, Unix can probably offer you several choices.

Although Unix isn't particularly easy to learn, the part of the system that communicates with the user is designed to be customized. This part of Unix is called the "shell," and it can be modified to make the system much more user-friendly.

Another source of Unix's power is its file structure. In Unix, everything is a file and all files are handled much the same way. One result of this regularity in structure is that the contents of a file or the output of a program can be sent automatically to another file or

Unix is a large multiuser multitasking operating system developed by Bell Laboratories and promoted by AT&T. Unix is complex, loaded with features, and—arguably—the wave of the future for business applications.

The Unix story starts at Bell Labs in the late 1960s. Ken Thompson, a programmer there, wrote the first version of Unix in assembly language for a PDP-7 minicomputer. In 1971, Thompson moved Unix to the popular PDP-11 minicomputer. He also translated parts of it from assembly language into a language called B. This version caught the eye of Dennis Ritchie, another Bell Labs programmer, who redid the B language and called the result C. Then all of Unix was rewritten in C.

By the early 1970s, Unix was commonly used inside Bell Labs, and it was attracting a lot of attention outside as well. For legal reasons, AT&T could not market computer products, so it decided to practically give away Unix to schools and colleges. For a small fee, a college received a license and a reel of magnetic tape containing Unix. But AT&T did not support the product.

The results were twofold. First, nearly every recent computer science graduate has had at least some exposure to Unix. Because it is so well suited to computer science education, almost all those students like Unix.

The other result is less favorable. Until very recently, there was no watchdog over Unix, and because it can be easily extended, many versions of Unix have been developed.

In 1978, the first commercial implementation of Unix appeared on a microcomputer. Others followed quickly.

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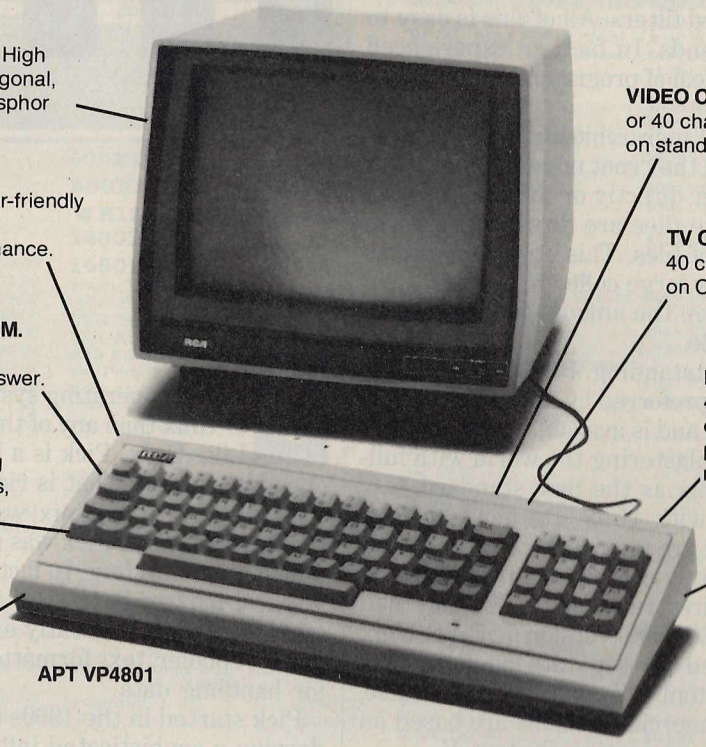

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program. Such an automatic connection is called a "pipe" in Unix. Along the way, the file can be run through other programs or utilities called filters. All of this is easy to specify with shell commands. In fact, an experienced Unix user can do a great deal of programming using just the shell commands.

Unix files are arranged hierarchically. The topmost file in the system is called the "root node" and all other files branch off of it, either directly or through a series of other files. Some of the files are directories, which link to other collections of files. This structure makes keeping track of even very large collections of information easy, a necessity given the amount of information a Unix system can handle.

Unix's strengths are outstanding. It is widely taught in schools and colleges, is preferred by a large and growing band of programmers, and is available on many computers. It also has AT&T plastering the world with full-page ads proclaiming Unix as the new standard.

But all is not heaven with Unix. Its most obvious disadvantage is that there are many different versions—none of which are completely compatible. In the decade or so since Unix was first released, AT&T has had several versions: Sixth Edition, Version 7, PWB/Unix (which isn't always counted as a separate version), Unix System III, and Unix System V. To make matters worse, most of the licensed commercial versions are based on System III, but AT&T is promoting System V.

Most AT&T versions of Unix were designed primarily as teaching and scientific systems. They are weak in areas that are important for business use, notably file and record locking, a feature businesses demand on multiuser systems to keep users from interfering with each other's files. So the manufacturers and software houses with commercial licenses for Unix have added their own extensions to provide these important features for business use.

Although the Unix kernel, the heart of the Unix operating system, is much the same on all versions of Unix, the utilities and extensions can be considerably different. Another problem is that Unix is not an easy system to master. Like most minicomputer operating systems, it is complicated; it was developed with the assumption that a resident expert would be around to maintain it. As a practical matter, this is less of a problem than it might sound. Almost all Unix implementations on microcomputers run on expensive multiuser systems, the kind that are typically bought with the aid of a consultant or through a systems house.

Applications software for Unix is relatively scarce. Packages are available for many scientific and engineering applications, but otherwise choices are limited.

Overall, Unix has a bright future. Recent surveys have shown that the demand for Unix programmers exceeds the supply, a trend that will probably hold for the near future. Unix's portability lets users take advantage of the features of new generations of computers without making their existing software obsolete. And with AT&T's full weight behind it, Unix will doubtless spawn an explosion of applications software soon.

# PICK

The Pick operating system is, in most ways, closer to Unix than any of the others we have discussed. Like Unix, Pick is a big, complicated multiuser operating system that is rich in utilities and features.

However, where Unix was designed as a software development tool, Pick was designed as an information management system. In fact, a relational database is an integral part of Pick. Also included is an English-like query language, a greatly extended version of BASIC, a print spooler, text formatter, and many other utilities for handling data.

Pick started in the 1960s as a government project to develop a sophisticated information management system. The programmers started out by designing the best information management tool they could conceive of without worrying about the limits of existing hardware. What they came up with was an imaginary computer, one that was carefully optimized for handling information. The next step in the project was to write a program to emulate this computer on a real machine—in the original case, an IBM mainframe.

Dick Pick was one of the programmers on the contract. When the government lost interest and the project became available, Pick bought the rights to it and set out to further develop the concept.

In 1973, Pick first appeared commercially on a minicomputer. In 1979, Applied Digital Data Systems offered Pick on a microcomputer. Since then, Pick has been moved to a number of other micros, such as Pertec, Altos, and General Automation. Pick Systems Inc. now sells Pick to end users for the IBM PC XT. Like all Pick implementations, PC Pick is the full Pick operating system. Programs that conform to the Pick standards will run on any computer with Pick.

In spite of its complexity and power, Pick is easy to use. Access, the query language, is simple to learn and lets even a casual user conduct elaborate searches and produce reports easily.

Like other nonprocedural languages, Access enables the user to concentrate on what he or she wants done, leaving how it is done to the computer. The user tells the computer what information is needed, and the computer handles the business of opening files or searching records. It is easy to customize the command dictionary by giving things different names, defining throwaways

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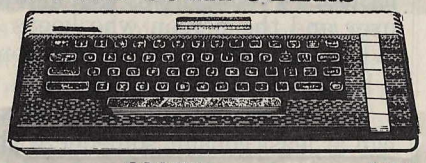

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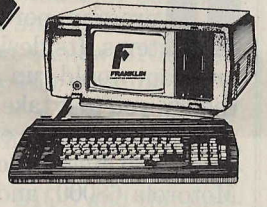

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(like "please"), or even translating to a foreign language.

Access is supported by a very sophisticated job control language called Proc. Access commands can be put together, called, and executed by name. The job control language also contains commands for a number of specialized functions, such as creating menus. In practice, Access, Proc, the terminal control language, and Pick BASIC all tend to blend together. You can mix commands from all of them to do the jobs you need done.

The Pick file structure is specifically designed for information management. The files are organized hierarchically, similar to the method used in Unix. Information is stored in data files, but it is defined and formatted by items (records) in the data dictionary files that point to those data files.

Information in a Pick data file is stored as strings of ASCII characters separated by special characters called delimiters. The fields between the delimiters automatically grow and shrink as needed to accommodate the data entered into them. In fact, you do not specify the size of a field at all. Pick has some elaborate commands for checking the size and format of data as it is entered or calculated, but they do not control the size of a field in the data file. This built-in flexibility avoids a number of subtle and extremely annoying problems which can plague other database systems, such as changing to 9-digit zip codes when the system is only set up for 5-digit zip codes.

There are no commas, dollar signs, or anything else in the data field. That information is supplied by the associated entry in the data dictionary. With the appropriate dictionary entry, 10 can be displayed as $10, 10.00, $10.00 or any of a number of other formats. That seems like a minor matter until you consider that otherwise several software routines are needed to properly format numerical data.

The part of Pick that most computer users will find familiar is Pick BASIC. Even here, though, there are considerable differences compared to Microsoft BASIC, which is used on most micros. Pick BASIC is a compiled language and contains the commands needed for structured programming to facilitate program development. It also has a COMMON statement and other features that encourage programmers to write their programs in modules and link them together.

Overall, Pick's features make it a very powerful operating system for a business environment, especially one in which a lot of people who have little computer experience need to get information. Since Pick has been around for more than a decade, it is well developed and has an ever-growing enthusiastic group of supporters.

A number of analysts predict that Pick will be a strong number two in operating systems for multiuser microcomputers. One or two daring analysts have even predicted it will surpass Unix in business use.

While Pick is good at what it was designed for, information management, it is emphatically not a do-everything system. Other operating systems are much better for scientific and engineering work or jobs involving real-time operations.

Like other minicomputer operating systems, Pick assumes a considerable gap in knowledge between the user and the person who keeps the system running. While beginners can use Pick comfortably, Pick is not a beginner's system to maintain.

This is also true of Unix, but a would-be Unix user can at least consult someone with Unix experience or buy a book on Unix. People with Pick experience, on the other hand, are relatively rare, and there are few if any books that will help a beginner understand the system.

## THE P-S

The p-System aims to achieve the highest level of program portability among other operating systems. Its designers intended that any p-System program would run as-is on any p-System machine. In theory, you just take the disk containing a p-System applications program out of, say, a computer based on the Intel 8086 microprocessor, insert it in one based on the Motorola 68000, and run the program.

Generally speaking, when someone refers to software portability on most operating systems, they mean source code portability. The high-level language version of the program is the same, but it must be compiled into native machine code for each computer. This is a big help to the software houses, but it means little to the computer owner since software companies almost never provide the source code. For the user, trading computers means making all his or her software obsolete.

Nicklaus Wirth acknowledged this problem when he invented the Pascal computer language. Wirth did not want to be tied to any one computer, so he specified that Pascal would compile programs to an intermediate code called pseudo code, or "p-code," which would be the same for any computer running Pascal. Then a machine-specific part of the Pascal compiler would turn the p-code into machine-language instructions the computer could execute.

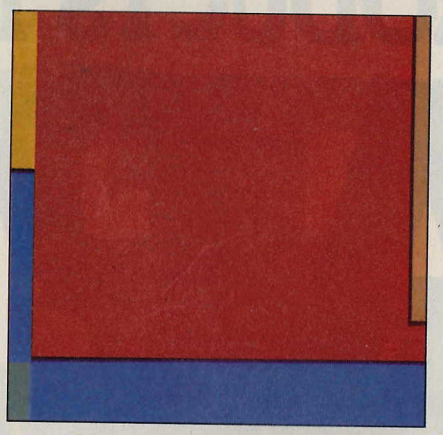
Based on this philosophy, the University of California at San Diego (UCSD) developed the Pascal-based operating system. To get the p-System running on a new microprocessor, a p-machine emulator is written for that computer. It can translate p-code into the computer's machine language for execution. The input-output rou-

As it stands now, Pick is full of rigidities. For instance, the only available programming language is Pick BASIC. It may be light-years ahead of microcomputer BASICs but if programmers want Pascal or C to develop applications software, they're out of luck. Another example is the lack of floating-point arithmetic. Pick Systems says it will remedy most of these problems with a new version called Pick Open Architecture, which the company hopes to have in a year or so.

Of all the operating systems we have looked at, Pick's future is probably the hardest to predict. It has enormous advantages in business and data management. But it is relatively unknown and it is coming to the market at a time when AT&T is spending millions of dollars to promote Unix.

But Pick has an intangible advantage. The people who use it generally like it. They like it so much they tend to become fanatics. It is an article of faith with Pick users that to experience Pick is to learn to love it. This kind of grassroots enthusiasm—the same kind of enthusiasm that Unix inspired in users during its early days—may make Pick a tremendous success.

## Y S T E M



tines, however, are not part of the p-machine emulator. They are in another section of machine code called the BIOS, for basic input-output system. (A new BIOS must be written for every kind of computer running the p-System.)

P-system programs are usually distributed in p-code, which communicate only with the p-machine emulator as if it were a real computer. The BIOS and the functioning of the p-machine emulator are normally invisible to applications programs.

From a user's standpoint, the p-System is menu oriented. Users give the system commands by selecting from menus. The menus are tree-structured, with multiple levels of submenus to let the user specify details of commands. Because everything is done with menus, commands are called with single keystrokes. In addition, the menus serve as reminders of what commands are available. A user can quickly learn to maneuver through the menu tree to do the necessary jobs.

In the p-System, files and I/O devices are handled as "volumes." A volume is anything that can output, input, or store information. A printer is a volume and so is a floppy disk. However a disk drive is not. Rather than having the "A-drive," "B-drive" convention of most operating systems, the p-System makes each disk a separate volume. The user calls for the volume by name and the system checks the drives to find it, eliminating the need to always redesignate a primary disk drive to use another disk.

Not surprisingly, the p-System includes a Pascal compiler among its utilities. It also includes both a line-oriented and a screen-oriented editor and facilities for creating and compiling large programs. The p-System helps programmers write software in stand-alone modules (called "units") which can be stored in system libraries and linked together at run time.

One of the nice features about p-System units is that the section declaring the services provided by the unit is separate from the rest of the unit. This lets the programmer make changes to the "implementation" section of the unit without creating unwanted side effects in the programs that use the unit.

On balance, the p-System has a lot of advantages. It is concurrent—meaning a user can do several things at once. In addition, Softech Microsystems, which markets the p-System, offers facilities for communication over a local network. It is easy to learn, functional, and has a good reputation among programmers. There is also a fair amount of software available for it, and developers have installed it on computers ranging from Apples to multiuser systems like the Sage.

The p-System's biggest disadvantages are that it is slow and that applications are not totally portable. The speed problem is a direct result of the way the p-System works. Although programs are compiled into p-code, the p-code is interpreted, like most BASIC programs. By their nature interpreted programs are slower than those fully compiled or written in native machine code. Although p-System programs aren't as slow as interpreted BASIC, because p-code is more efficient than BASIC, there is still a speed penalty.

Those who support the p-System claim that for most programs this speed penalty is negligible. In most cases, they say, a microcomputer's speed is affected more by I/O speed than its processing speed. That is, a computer spends most of its time reading and writing to disk or waiting for input from the keyboard. Since p-System I/O is fast, the user on a typical application isn't likely to notice the speed difference, they claim. In fact, they say, a p-System program will in some cases actually run faster than a machine-language program. In addition,

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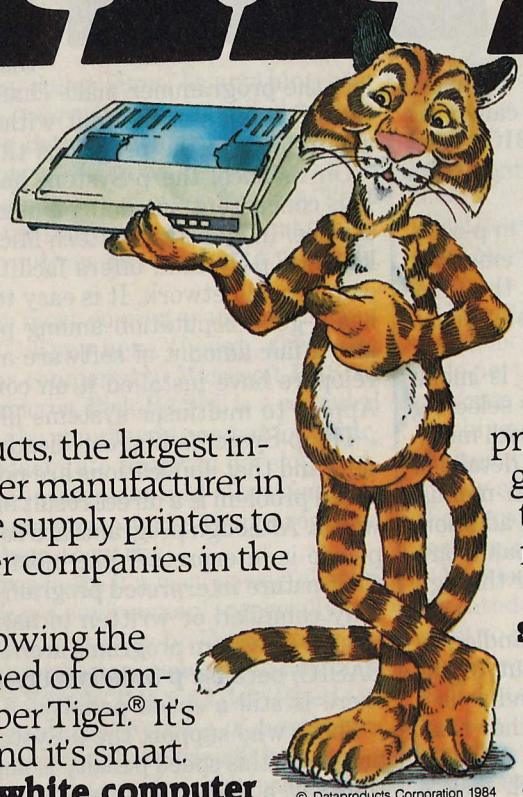


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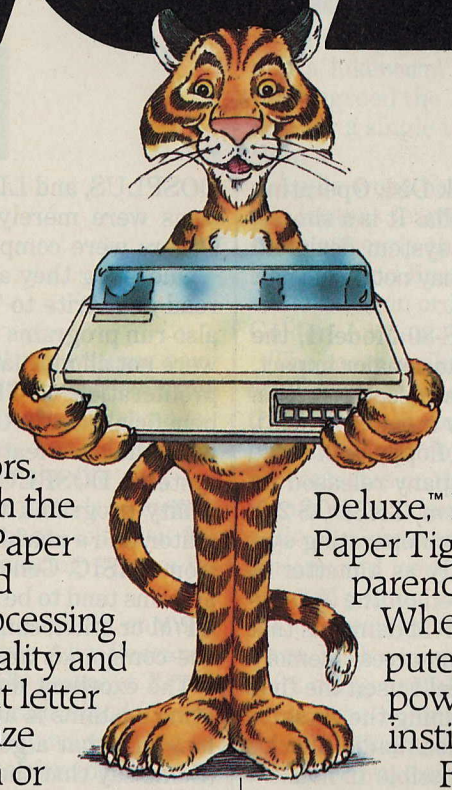

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the p-System provides utilities called native code generators which can be used to insert small portions of machine language into a p-System program.

More interesting is the reason the p-System cannot offer total software portability. This problem stems from differences among computers it can't paper over.

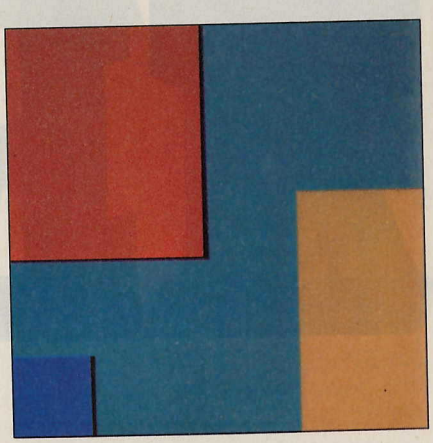
For example, most computers produce a display of at least 24 lines of 80 characters per line. However, the Apple II has fewer lines and only 40 characters per line. As a result, there tend to be two kinds of p-System programs: the ones for the Apple II and the ones for other computers.

The plethora of disk formats used on microcomputers also hinders portability. There are about four dozen of them and they are all incompatible. Softech has tried to deal with this situation by defining a disk format called the Universal Medium for p-System programs. There are translation programs to convert the Universal Medium into the native disk format for computers that can't handle the Universal Medium directly.

Applications software may not be totally portable under the p-System, but it probably comes closer to the ideal than any other microcomputer operating system, with the possible exception of Pick.

Certainly, the idea of total program portability is attractive, particularly to a user who has just had to lay out a bundle to replace his or her entire software library. As users become accustomed to having more than one operating system for their machines, the p-System may become increasingly popular.

# TRS-DOS



TRSDOS (for Tandy Radio Shack Disk Operating System) is decidedly plain vanilla. It is a simple, uncomplicated disk operating system designed for home and small business users. It may not be elegant but it is functional.

TRSDOS was spawned by the TRS-80 Model I, the first of the all-in-one computers to make a major impact. The Model I was released in 1977 as a cassette system with its operating system in read-only memory (ROM). Radio Shack soon offered an optional floppy-disk drive for the Model I, and in 1979, the company released its first full-featured disk operating system, TRSDOS 2.0.

Radio Shack decided to write its own operating system partly out of necessity and partly as a matter of policy. Although the Model I was based on the Z80 microprocessor, it could not use CP/M. CP/M demands that the first 256 bytes of memory be random-access memory and available to CP/M, while the Model I used the first 12K bytes of memory for ROM (containing the cassette operating system and BASIC). Besides, Radio Shack's policy was to produce as much as possible in-house.

But TRSDOS 2.0 was rather limited and definitely slow; to make matters worse, early versions had a number of bugs. Radio Shack delayed bringing out improved versions, so other developers leaped into the breach, causing a proliferation of operating system variations like nothing the microcomputer idustry has seen, before or since. The most notable offerings were NEWDOS, DOSPLUS, and LDOS. Some of the new operating systems were merely patched-up versions of TRSDOS. Others were complete rewrites.

One thing they all had in common was the ability to read and write to TRSDOS disks. Most of them could also run programs written for the others although they were not all mutually compatible. As it turned out, this proliferation of TRSDOS variations had a couple of beneficial effects. One was that developers competed to build the most features and utilities into their operating systems. DOSPLUS, for example, has 30 commands, 15 utility programs, two BASIC interpreters, a program editor, and a machine-language sort routine you can call from BASIC. Generally speaking, the TRS-80 operating systems tend to be richer in commands and utilities than CP/M or other, similar operating systems. Furthermore, the commands are generally easier to learn.

The excellent documentation on most of these operating systems is another benefit. Radio Shack learned long ago that a good instruction manual is important. (Some say that the documentation for TRSDOS is better than the system.)

One of TRSDOS's idiosyncrasies is that only a small part resides in RAM all the time. Like most operating systems, TRSDOS is overlaid—part is in RAM and the rest swapped in and out as needed. But because the TRS-80 doesn't have a lot of RAM (a fully expanded Model I or III has only 48K bytes) the amount of

TRSDOS kept in memory is unusually small, thus increasing the amount of disk I/O. To compensate, TRSDOS uses a hashing algorithm to speed up searches of its file directory. In effect, the hashing algorithm breaks the file directory up into neighborhoods and tells the operating system in which neighborhood information on a file is to be found. This speeds up the disk I/O somewhat, by cutting the time needed to find the parts of a file on the disk. But because so much of TRSDOS is on the disk, the disk containing the operating system must be kept in the first drive all the time. This is noticeably less convenient than MS-DOS systems with large memories that allow the disk to be removed.

Perhaps the biggest disadvantage of TRSDOS is that it is confined to a single make of machine (plus a couple of clones). Given the smaller number of machines out there, there is less software available for TRSDOS machines than there is for generic CP/M- or MS-DOS-based computers.

This is not to say that TRS-80 users suffer a software drought; the TRS-80 software market has always been a lively one. A lot of good programs are available for the TRS-80, and most of the popular CP/M applications software is eventually brought over to TRSDOS.

But we may be seeing the beginning of the end of TRSDOS. Last year, Radio Shack replaced the Model III with the CP/M-compatible Model 4. (However, little CP/M software is available on the Model 4 formatted disks.) Although a new proprietary operating system, TRSDOS 6.0, comes with the Model 4, it is one that Radio Shack did not develop. TRSDOS 6.0 is in fact only a new implementation of Logical Systems' LDOS. Many industry watchers see this move as a strategically planned phasing out of TRSDOS.

For now, the future of TRSDOS is somewhat cloudy. It is unlikely that TRSDOS is going to go away any time soon; a large number of TRS-80 Model Is and IIIs remain in use, and good applications software for TRSDOS is abundant. Supporters argue that TRSDOS is superior to CP/M; however, the availability of CP/M on the Model 4 removes a major incentive for companies to translate their CP/M programs into TRSDOS.

# MACINTOSH/ LISA

The Macintosh and Lisa operating systems have little in common with any other microcomputer operating systems. They are large, quite complex, and work the computer's microprocessor hard. But the reason for all that complexity is to make life easy for the user. There are no long lists of commands to memorize or elaborate syntactical requirements to follow. Instead, the user manipulates the operating system by using a mouse to point at icons.

Apple's advanced operating systems are built on work done in the 1970s at Xerox Corp.'s Palo Alto Research Center (PARC). During that period, the teams at Xerox PARC were developing and refining a radically different approach to computers. In essence, they were trying to adapt a computer to the user instead of forcing the user to adapt to the machine.

Apple applied the PARC approach in designing its new computers that use a new generation of microprocessor, the Motorola 68000. The first result was the Lisa, a $10,000 business computer Apple introduced early in 1983. Lisa drew rave reviews from the technical people, mixed reviews from the financial and business press, and a lukewarm response from consumers. Although most agreed the Lisa was neat, it was also very expensive for a single-user computer. What's more, Lisa was slow.

Apple went back to the drawing board and applied the lessons learned to the Macintosh. When the Mac came out early this year the technical people raved, the business and financial press was enthusiastic, and consumers began ordering Macs like Saturday night at the Golden Arches.

The most striking feature of the operating systems on the new Apple computers is their user interface—the way you make them do things. The interface is nonprocedural and object-oriented—in other words, the user concentrates on the job, not how to do it, and gives commands by manipulating objects on the screen. To open a file, for instance, you "pull down" a menu and select options and icons, such as a file folder, using a mouse-directed pointer and a single button on top of the mouse.

This strategy makes the Mac and Lisa very easy to learn. With a minimum of instruction, nearly anyone can start doing useful work on these machines in a matter of minutes. Some Mac owners even brag that they have never unwrapped their instruction manuals. That may be a poor way to get the best out of your computer, but it is a powerful testimony to the system's ease of use.

Applications programs for the machines are expected to use the operating system's user-interface routines to communicate with the user. If the software companies writing the applications go along, it will make applications a lot easier for users to learn. So far, most of the companies that have announced software for the Mac

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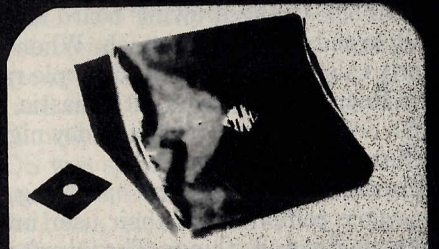

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say they intend to use those routines.

Those applications will be able to draw on other features of the Mac as well. For instance, the machine's ROM contains everything a word-processing program needs for a what-you-see-is-what-you-get display of documents, including several different type fonts. There are also elaborate graphics routines built in.

The advanced operating systems of the Mac and Lisa make the machines both powerful and, for someone who has never used a computer before, especially easy to use. Even people who have used computers appreciate the ease with which they can do even relatively complicated tasks. Moreover, the structure of the user interface built into the operating system encourages experimentation and is just plain fun to use.

For all that, the Mac has not been greeted with unmitigated praise. The Mac operating system certainly is advanced, but people have questioned if its advancement is in the right direction.

Because the Mac operating system is so highly integrated, and because applications are expected to use the Mac's high-level user interface, software for the Mac is not easy to develop. Transporting a program to the Mac (or the Lisa) isn't just a matter of a little tweaking and a quick recompilation. It takes time, and that hurts software availability. Even before the Mac was announced, Apple was working with software companies to make applications available. Yet, four months after the machine was introduced, not much software was forthcoming.

The time and effort spent to bring software over to the Mac and Lisa can't be amortized over several brands of machines. In an era when the need for software and operating system portability is seen as a universal need, the Mac and Lisa approach represents a throwback to the days of the proprietary operating system.

The system is proprietary, and it is probably going to stay that way. We won't see other computer manufacturers offering "Mac compatibles"—at least not with the present copyright laws. Apple figures it took over 200 programmer-years to develop the Mac and Lisa operating systems and bundled software, and it plans to protect that investment.

The biggest questions, though, revolve around the mouse-icon style of user interface. Some question whether or not that sort of simple-minded approach is necessary for a business computer. More important, the Mac and Lisa user interface was implemented at the expense of processing power. Other computers using the same microprocessor can do more and do it faster. Is the friendliness of the Mac and Lisa user interface worth the cost? Some people think not.

However, even the detractors who sneer at the Mac as a "glorified game machine" give Apple high marks for trying to make computers easier to use. Icons, mice, and windows may not be the ultimate answer to interacting with computers, but applications and operating system software developers are putting more effort into making life easier on the human side of the interface. In that sense, the Mac and Lisa operating systems will undoubtedly have a big influence on the industry. □


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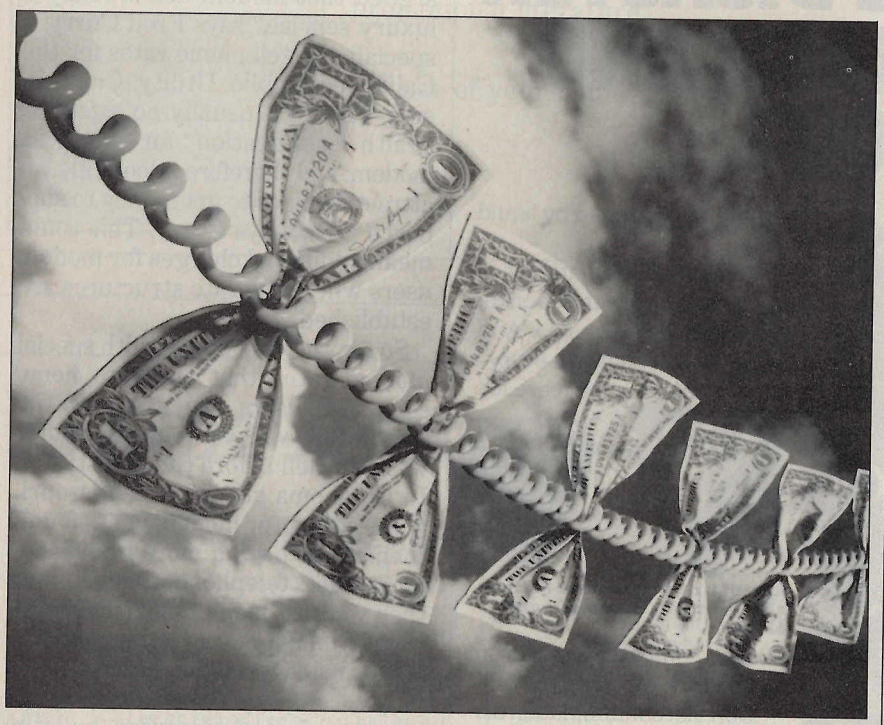
# RANDOM ACCESS

## A wide-ranging look at ways to get more from your personal computer


Modem Users Face Deregulation Page 149

Spelling Checkers Provide Backup Page 155

# Modem Users Face Deregulation

If you're one of the half-million or so Americans who use modems to access bulletin boards and information services, you're undoubtedly concerned about what the breakup of AT&T means to you. With options such as measured versus flat-rate local service and the possibility of additional charges for modem users, you're going to have to do a little more thinking about any options you have for telephone service.

Inflation and deregulation mean that everyone's phone bill, especially for local calls, will go up in the next several years. In one of the more conservative estimates, the Federal Communications Commission (FCC) predicts a 40 percent increase in the cost of local service by 1989. But long-distance charges, which formerly supported inexpensive local service, should remain constant or even decrease slightly.

The elimination of cross-subsidies that have structured residential telephone rates for the last 90 years not only means higher phone rates, but it also means that phone companies are looking for rates that more closely track the cost of serving customers. Generally speaking, people who use the phone more will pay more, even for local calls. Modem users fall into this category. According to Bill Taylor, the division manager for access tariffs for the Central Services Organization (CSO) of the Bell Operating Companies, modem users typically make longer calls than conventional callers. Studies by GTE Telenet bear this out, showing that the average modem call lasts about 10 minutes longer than an ordinary call. Because new billing structures will take the duration of each call into account, the new rates will have a major impact on people who send data over telephone lines.

### Measured Service

In an effort to bring the price of service more in line with the cost of providing it, many telephone companies are offering local measured service under which customers are billed according to their use of the telephone instead of paying a flat monthly charge. Some companies base measured service solely on the number of calls, but the more common method is to base the charge on number, duration, and distance of calls.

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Although it's spreading rapidly across the country, measured service is optional in almost all areas where it is offered. Most phone companies still offer R-1 or POTS (for Plain Old Telephone Service), albeit at a higher monthly charge. Because of the crazy-quilt pattern of rates, no one knows how much more a typical modem user will end up paying under measured service, but Taylor says it would be "significantly" more.

In addition to dealing with measured service, modem users may also face extra charges. "It can be argued that modem use is really a luxury service," says Fred Curry, a specialist in telephone rates for the California Public Utility Commission. "There is usually no safety or health justification for using a modem, and therefore it looks like an attractive place to get money to support POTS," says Curry. This could mean additional charges for modem users when new rate structures are established.

So far, the only places with special modem rates that apply to home computer users are some of the states that were served by Southwestern Bell before the divestiture. In Oklahoma and part of Missouri, home computer modem users found themselves paying more than $40 a month for telephone service, and they weren't happy. One of the most vocally unhappy was Robert Braver of Norman, Oklahoma. Last year the phone company found out Braver was running a computer bulletin board from his home and started charging him the higher rate. Braver's response was to form the Oklahoma Modem Users Group and start a letter-writing campaign that got him widespread publicity.

Southwestern Bell maintained the rate was a relic of the 1960s, and the Oklahoma Public Utilities Commission (PUC) changed the rate as part of the company's fall, 1983, rate case. But what the PUC and Southwestern Bell came up with probably won't appease Braver. Under the new rate schedule, there is no extra charge for residential users who are tapping into information utilities or

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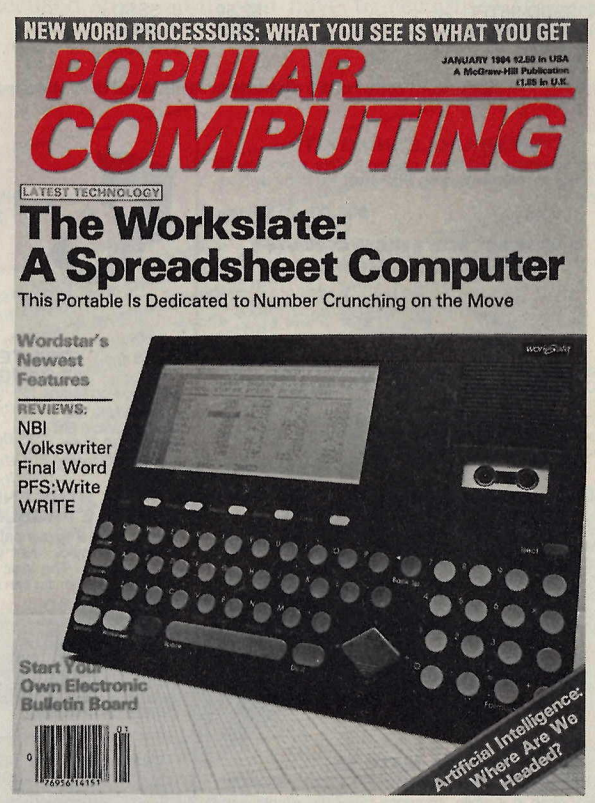


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### Where Does This Leave You?

To figure out which service is the cheapest for your uses, first call your local phone company's toll-free question line to find out what options you have. If you have the choice of flat-rate or measured service, analyze your local calls to determine whether you'll come out ahead with flat-rate charges or a measured bill. Any modem user who is already on measured service should compare its price to the cost of going back to POTS. A number of states also offer alternatives for intrastate long-distance service. The information in the front of your telephone directory will help you evaluate your use and figure out what's right for you.

For out-of-state long-distance calls, AT&T's service should become less expensive as new local rates take on a greater share of operating costs. But you will probably want to compare AT&T with alternative long-distance services like MCI and Sprint. For information about all three, call AT&T at (800) 222-0300; MCI at (703) 448-0707; and Sprint at (800) 521-4949.

But the bigger question of how the phone companies will treat modem users is harder to address. Any special rates will be discussed by each state's Public Utilities Commission, and concerned users will have to keep an eye out for public notices of PUC rate hearings. Users groups and local bulletin boards should take an active role in alerting their members and callers to these hearings. Those who establish phone rates should be made to understand that home users tend to do their calling during off hours—because they do not compete with business users, they impose much less cost on the system. By banding together, members of the "Network Nation" can bring pressure to bear and ensure that home modem use remains affordable.

—Rick Cook

# Spelling Checkers Provide Backup

Ever since the days when I used to win the spelling bees in Mrs. Sutter's fourth grade at Collier Street Elementary School, I've considered myself a pretty good speller. Somewhat smugly, I never thought I could profit from an electronic spelling checker—they were for spelling-bee washouts. I felt confident that my own careful proofreading, usually backed up by a once-over from my husband, took care of any typos and misspellings.

But I've just been given my comeuppance. While testing out a spelling checker program recently, I decided to try it on some of my own articles. One of the pieces I checked was a 2600-word manuscript I'd completed some months back. After comparing the article against its own modest dictionary, the spelling checker found four typos and, horror of horrors, a word that I'd actually misspelled out of ignorance. (Do I have to tear up my Best Speller award, Mrs. Sutter?)

Justly humbled, I'm now ready to add a spelling checker to my toolbox of electronic helpers. But that doesn't mean a spelling program is a panacea. It's no substitute for a thoughtful human proofreader with a well-thumbed Webster's, primarily because it cannot detect incorrect usage. For example, one of my common errors is repeating the same word, as in "the the company," but a spelling checker won't see anything wrong with that. A spelling program shouldn't be considered anything more than an additional tool for the human proofreader. It's a double check that can ferret out those spelling errors that sometimes elude even the most careful eyes.

### How They Work

Most spelling checkers attack the task in a very straightforward way. After you store your document on disk and leave your word-processing program, you put your spelling checker in charge and give it the name of the document file you want to check. The program "reads" your document and compiles a list of unique words, throwing out all second or later occurrences of a word so that it doesn't have to look it up more than once. Then the spelling checker looks for each of your words in its own disk-based dictionary. If you've used a word that's not in its dictionary, the program reports it as a possible error. You decide if the word indeed needs to be corrected.

Spelling programs commonly report dozens of correctly spelled words as potential errors. For every misspelled word, you may have to review 10 or 20 falsely accused spellings. This wholesale calumny of innocent words can be blamed on the limited capacity of the floppy disks used in most micros—a disk-based dictionary is unlikely to contain all words you might use.

Even though most spelling programs use a data compression technique to squeeze as many words as possible onto a floppy disk, there simply isn't room for the 155,000 entries of a typical desktop dictionary on a disk that holds only 160K bytes or less. Remember that computer systems usually use a byte of memory to represent one letter—until someone finds a way to store an entire word in just one byte, or until high-capacity disk drives become more common, software manufacturers will have to leave words out of their dictionaries.

Most spelling programs have dictionaries of 26,000 to 50,000 words. That may sound fairly respectable, but you have to recognize that an

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entry in a disk-based dictionary is not really equivalent to an entry in a printed dictionary. The software dictionaries typically count plurals and various forms of the same verb as separate words. For instance, "sky" and "skies" would be two distinct words in a disk dictionary, but a printed dictionary would count them as parts of a single entry. Thus, if a printed dictionary and a disk dictionary had the same number of entries, the book might include three to five times more actual words. And with printed dictionaries containing as many as three times the number of separate entries in today's disk dictionaries, you can see that the book might offer five to ten times more words than the disk.

In an attempt to cram more words into the limited space, some spelling checkers use a dictionary comprising a list of word roots and an algorithm that joins them with common prefixes and suffixes. The disadvantage of this approach is that root/suffix mismatches such as "accessable" or "familys" can slip by undetected.

**If you're a rotten speller and don't want your ignorance to show, a spelling checker can help you.**

If you have high-capacity disk drives that give you space for a larger dictionary, though, most spelling checkers let you add new entries to the dictionary disk. This option gives you greater flexibility. As time goes by and you add more and more words, you'll spend less time dismissing the charges against innocent words. This is especially convenient if you do a lot of writing with a specialized vocabulary, for it allows you to develop a dictionary customized to your particular needs.

### Two Examples

I looked specifically at two different spelling checkers—an inexpensive, no-frills model and a highly regarded, top-of-the-line product. The less expensive Easyproof, a $49.95 package from Norell Data Systems (3400 Wilshire Blvd., POB 70127, Los Angeles, CA 90010, (213) 257-2026), is an extremely quick program (it checks 6000 words per minute, according to the company), but it does let an occasional misspelling slip through (although the chances are less than one-half of one percent, the company claims). The reason behind both of these characteristics lies in Easyproof's unusual method of checking a word against its dictionary.

Using a technique known as "hash coding," the program runs a word through seven formulas that encode it as a series of bits. The spelling checker then determines if this numerical representation fits, or "hashes," into the dictionary. This rather sophisticated approach makes excellent use of disk space as well as enhancing the program's speed, but because rare pairs of words (one misspelled) could hash into the same spot in the dictionary, the method is not foolproof.

The higher-priced spelling checker, The Word Plus ($150, from Oasis Systems, 2765 Reynard Way, San Diego, CA 92103, (619) 222-1153) has a literal dictionary to ensure that no guilty words get away. It also has a nice selection of extra features that help justify its higher cost. For example, it can assist those of you who have trouble with homophones, those words that sound alike but are spelled differently, such as "desert" and "dessert," "assent" and "ascent," or, my own personal bugaboo, "it's" and "its." At your request, The Word Plus will mark all the homophones in your text with some seldom-used character, thus enabling you to use your word processor's search function to find the homophones so that


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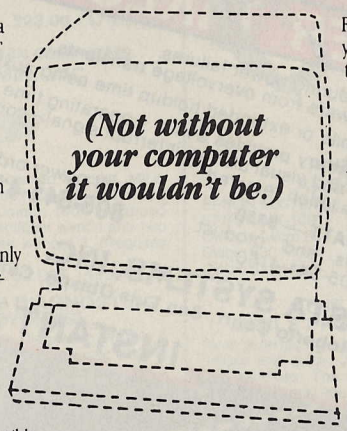


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you can look up their meanings.

While both spelling checkers present you with lists of suspect words, Easyproof merely marks the confirmed errors in your document, which means you have to go back to your text editor to correct the mistakes. The Word Plus, on the other hand, actually inserts the corrected spelling into your document after you type it in. In addition, The Word Plus allows you to see the word in context before you decide if it's right or wrong, and it will look up similar words in its dictionary for you. For instance, it might warn you that "recieve" is suspect. When you ask for the look-up function, the program will suggest the words "receive" and "relieve" as possible corrections.

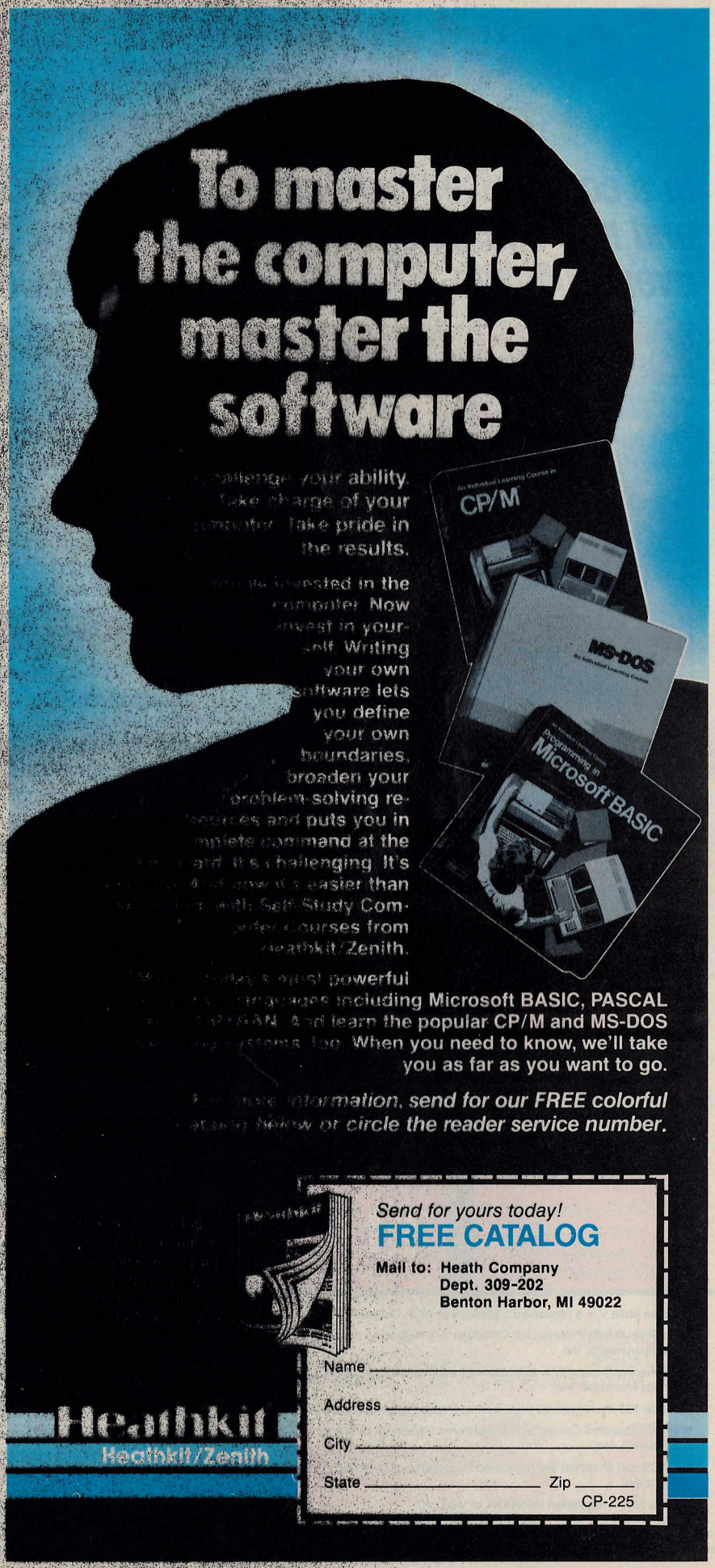
The Word Plus will also delight crossword-puzzle fans who don't mind a little help when they're stuck. Its find program will search the dictionary for words that meet certain conditions. Suppose you need a four-letter word starting with *t*, ending with *p*, and meaning "ensnare." Simply insert The Word Plus into your disk drive and type in Find T??P. The program will propose four possibilities: tamp, tarp, trap, and trip. Now you can choose the right one. It also has an anagram program that will unscramble the words in your Sunday paper's anagram puzzle.

### A Useful Investment?

Is a spelling checker for you? If you're a rotten speller and you don't want your ignorance to show, a spelling checker can help. But you must be prepared to do a lot of seemingly superfluous work, looking up those falsely accused yet innocent words that are not in the disk dictionary.

If you're a reasonably good speller, $80 to $300 might be too high a price for a bit of extra insurance against typos and memory lapses. But if you're like me, you'll raid your piggy bank and invest in a good spelling checker. I don't want the world to know that all these years I've been living a lie—if a program spells better than I can, I want it working for me.

—Dara Pearlman

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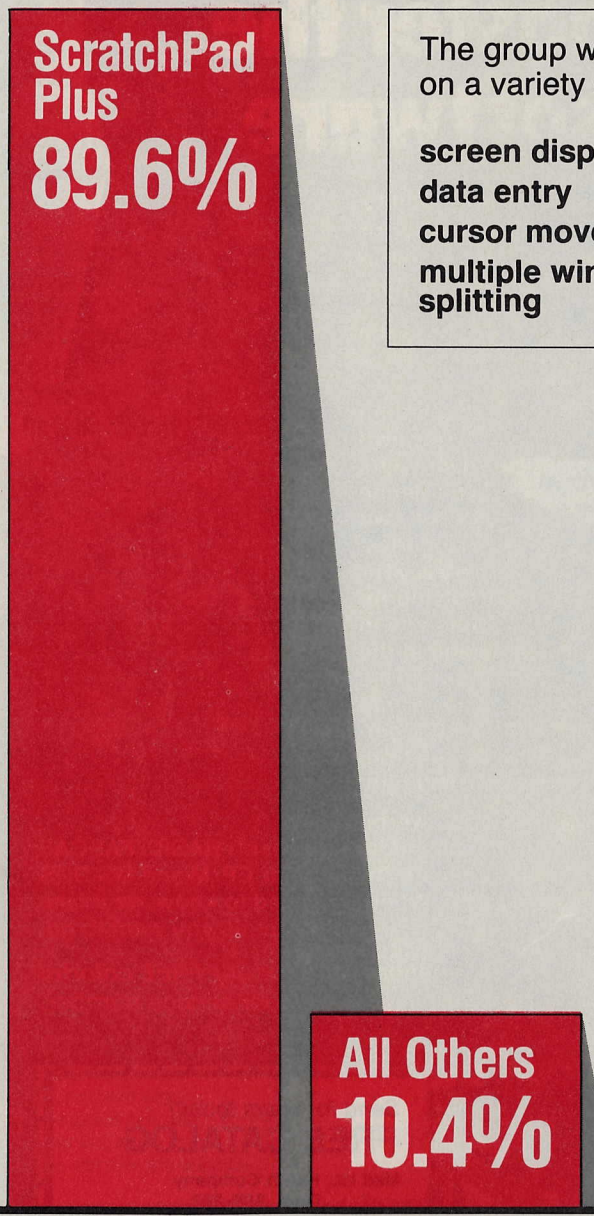


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| Full data entry validations includes case conversion, range checking, and pattern matching | YES | NO |
| Extensive on-line help is available | YES | NO |
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| User may define new command vocabulary | YES | NO |
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| Simple file structure allows easy access to data | YES | NO |
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# Tracing a Bee's Family Tree

by Michael W. Ecker

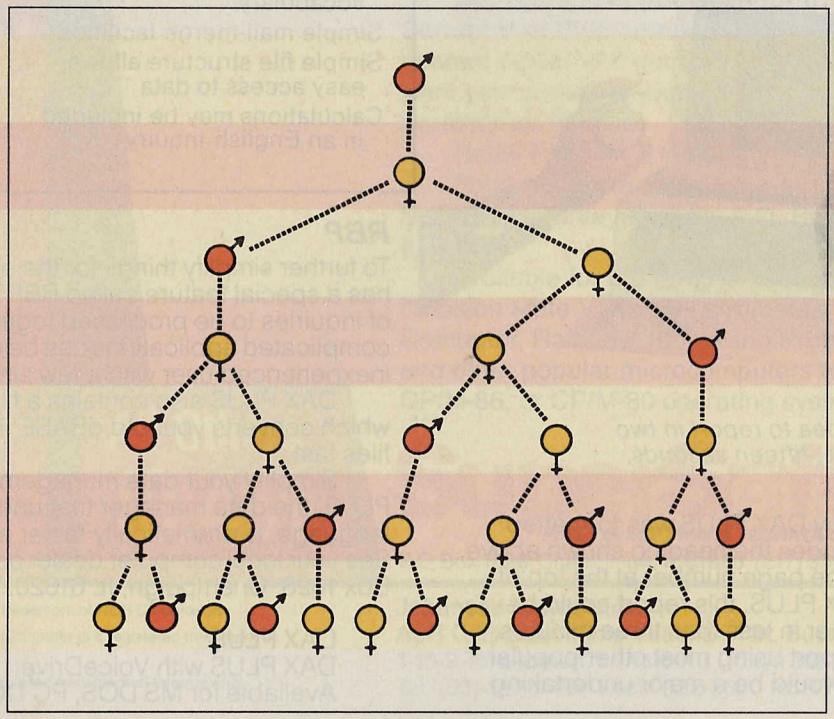
This month's programming challenge involves the family tree of a male bee. Suppose we start out in generation zero with just one male. Let us assume that each male bee serves to help produce only one female bee in his lifetime. On the other hand, let's assume that each female bee born later finds a male who fertilizes some eggs such that she produces exactly one bee of each sex. This situation is replicated in each generation, producing the curious pattern shown in the diagram.

If we look at the diagram of the male bee's family tree under these simple conditions, we find that the numbers of bees in each generation are 1, 1, 2, 3, 5, 8, 13, and so on, and form a famed sequence, the Fibonacci sequence. The sequence is named after a medieval scholar, Leonardo of Pisa, who was called Fibonacci and who was probably the premier mathematician of his time (around the year 1200). The sequence has the special feature that each number is the sum of the two previous numbers. Can you write a program that will, starting from the "zeroth" generation, give the number of bees in each generation? Also, can you predict how many times as large each successive generation will be as compared to the previous one? (Note that the fifth generation has 8/5=1.6 times as many bees as the fourth generation has.) □

*Write a program that computes how many bees are born in each generation*

**Editor's Note:** Next month Dr. Ecker will provide a solution to the bee's family tree problem as well as present a new recreational puzzle to solve with your computer. In the meantime please send comments, questions, solutions and suggestions to Dr. Michael W. Ecker, Contributing Editor, *Popular Computing*, 129 Carol Dr., Clarks Summit, PA 18411. Individual replies will be given if you include a large, self-addressed, stamped envelope.

Contributing editor Dr. Michael W. Ecker is Assistant Professor of Mathematics at Worthington Scranton Campus, Pennsylvania State University.




**The numbers of bees in each successive generation form a Fabonacci sequence.**

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# Tracing a Bee's Family Tree

by Michael W. Ecker

This month's programming challenge involves the family tree of a male bee. Suppose we start out in generation zero with just one male. Let us assume that each male bee serves to help produce only one female bee in his lifetime. On the other hand, let's assume that each female bee born later finds a male who fertilizes some eggs such that she produces exactly one bee of each sex. This situation is replicated in each generation, producing the curious pattern shown in the diagram.

If we look at the diagram of the male bee's family tree under these simple conditions, we find that the numbers of bees in each generation are 1, 1, 2, 3, 5, 8, 13, and so on, and form a famed sequence, the Fibonacci sequence. The sequence is named after a medieval scholar, Leonardo of Pisa, who was called Fibonacci and who was probably the premier mathematician of his time (around the year 1200). The sequence has the special feature that each number is the sum of the two previous numbers. Can you write a program that will, starting from the "zeroth" generation, give the number of bees in each generation? Also, can you predict how many times as large each successive generation will be as compared to the previous one? (Note that the fifth generation has 8/5=1.6 times as many bees as the fourth generation has.) □

*Write a program that computes how many bees are born in each generation*

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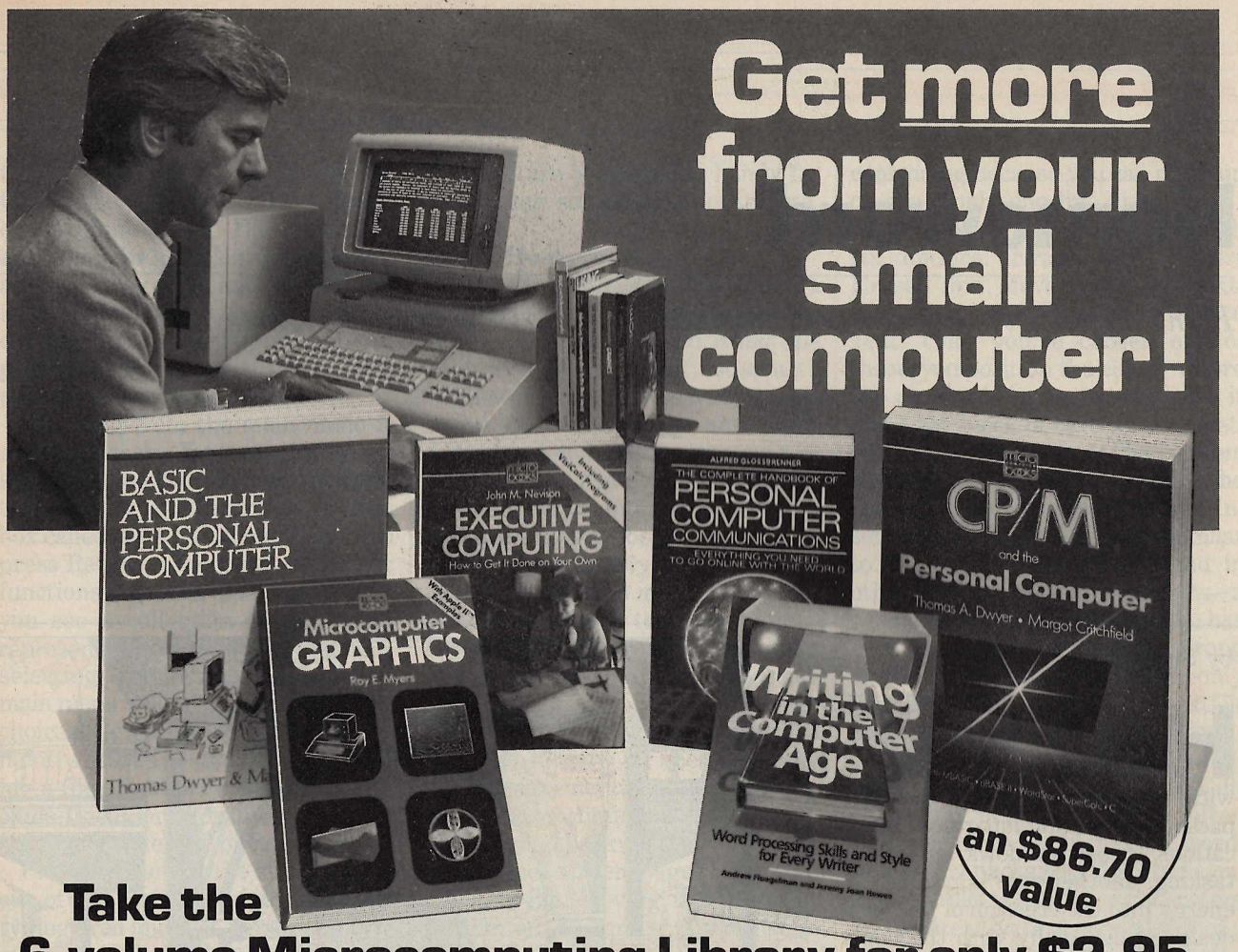
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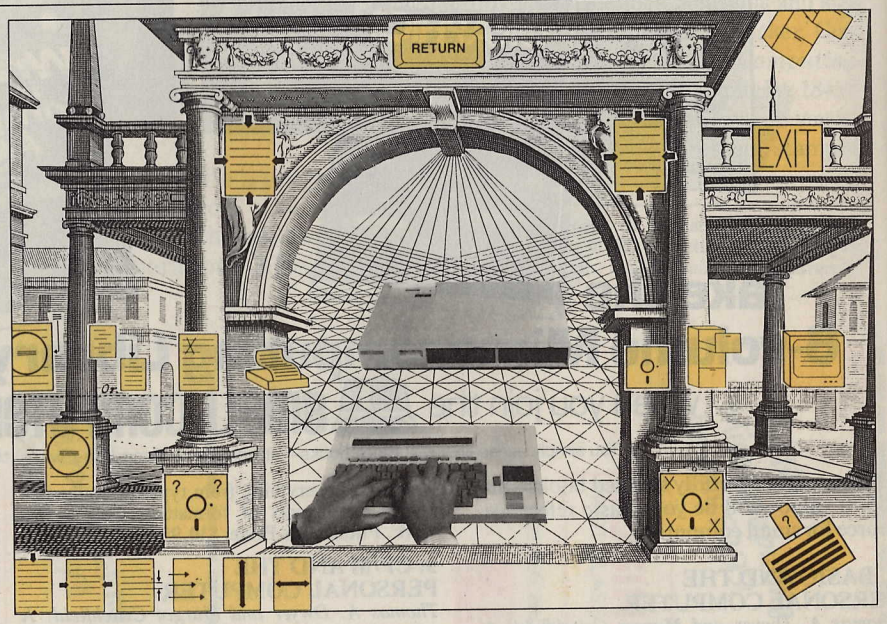
Popular Computing 8/84

# Homeword

*Icons make this home word processor especially easy to learn and use*

by Susan Hetzel




Home computer users, rejoice! While one side of the software industry is coming up with ever more powerful business packages featuring integrated applications, screen windows, and multitasking, another side is putting its energy into the creation of products designed especially with the home user in mind. These packages are utilitarian, inexpensive, and easy to use—qualities that are embodied to the fullest in Sierra On-Line's Homeword word-processing program.

Billed as a "home utility program," Homeword is designed to help the home user write and print personal and professional letters, address lists, monthly budgets, recipes, and school assignments. Perhaps the least intimidating word-processing program on the market, Homeword is attracting a wide range of users of all ages and with varying levels of computer expertise. The $69.95 package for Apple and Commodore systems (as well as the $75 version for the IBM PCjr available from IBM) uses graphic icons to designate its menu-based commands, features an audio tutorial on cassette tape, and offers enough editing and formatting functions to qualify as a full-fledged word processor.

Getting started with Homeword couldn't be easier. The cassette tape guides you through the main menu choices and acquaints you with the typing area. You're first shown how to type and correct a document (in this case, a short letter) and then how to file the document, retrieve it from the file, edit the saved document, and view it on the screen before it's printed.

The second tutorial lesson helps you configure the program for your printer and shows you how to prepare or initialize the document disk. Having taken about 20 minutes to familiarize yourself with the basics, you're now ready to start writing.

## Command Icons

Homeword's cassette tutorial makes it unusually easy for the beginner to get started, but the program's use of graphic icons rather than command names is what really distinguishes it as a piece of software designed for the home market. These icons, which replace the sometimes cumbersome command sequences of other programs, are simple graphic representations of the functions offered by the main menu and its submenus. The main menu, for example, includes a printer icon that you choose to access the program's printing functions, a page of print with some sections crossed out that signifies the Edit commands, and a file cabinet representing File commands. Also, an unorganized page with an arrow pointing to a formatted page stands for Homeword's Layout functions, an arrow pointing

Susan Hetzel is a freelance writer living in Medford, New Jersey.

Illustration by Marc Yankus

to different choices represents the Customize submenu, and a floppy disk signifies the Disk Utilities submenu. In addition to providing an intuitive command menu, the icons reduce the need for written documentation. Beginners will appreciate not having to refer to a manual every few minutes.

Choosing from the main menu is a simple task. You use the arrow keys to frame the icon representing the function you want with an open box called the icon cursor. When you press Return, a submenu of specific functions appears, and once again you see a collection of icons that represent your choices. For example, selecting the file cabinet from the main menu will give you four further choices: Get Document, Save Document, Insert Document (for inserting a file saved previously), and Include Document (for inserting or attaching a different document).

Pressing the Escape key gets you out of the main menu and into the typing area and vice versa. The typing area is divided—you enter text in the upper portion and find expanded status information below. Be wary of what the manufacturer is calling split-screen capability, which more commonly refers to a program's ability to display more than one text file at a time. The partitioning of Homeword's screen provides a status enhancement rather than multiple-document capabilities.

The status information *is* worth the screen space Homeword gives it, though, especially for beginners. You can tell at a glance how much space remains both in your computer's memory and on disk, which means you don't have to wonder how far away a "disk full" warning is. The final document page number of your currently displayed screen is also included in the status information.

An even more helpful status indicator is the graphic depiction of a printed page at the lower right corner of the screen. A blinking mark shows you where you are on the page, and changes in line spacing, centering, indentations, headers, and footers are immediately displayed. This feature is especially handy for formatting single-page documents.

### Using Homeword

Often the features that make a program easy to learn get in the way when it's time to begin using the program in earnest, but not so with Homeword. Despite its wide assortment of text-editing and text-formatting capabilities, the system is as easy to use as it is to learn.

When you've entered a document and are ready to begin editing, for example, you simply select the Edit icon from the main menu. This gives you access to basic text-editing functions such as inserting, deleting, moving, and copying text. The relative ease and speed with which these functions can be performed depends largely on the program's cursor movement. A two-keystroke control-key command moves you forward and backward by character, word, line, screen page, formatted page, or file. Moving to the top or bottom of the screen is more time consuming because you can move up or down only one line at a time.

The Edit menu provides you with six options: Erase Text, Insert Erased Text, Move Text, Copy Text, Find Text, and Find and Replace Text. Once you've chosen one of these, you position the cursor where the change is to begin and move it along the block of text you're deleting or repositioning. The system highlights this text—or what the manual calls "painting" it. The Insert Erased Text command is similar to the "undo" command found in other word-processing programs—a welcome feature to anyone who has ever accidentally deleted the wrong text. It does, however, handle only your most recently erased text; it can't store any previous deletions.

The global and local search-and-replace functions offered by the Edit mode are powerful options often found in more sophisticated word-processing packages. The Find command scrolls through your document and locates the first occurrence of a particular word or phrase, repeating the process as needed. The Find and Replace operation does the same, but it substitutes another word or phrase for the one you wish to change. You can pause after each replacement or execute all of the changes at once.

Homeword's well-chosen array of editing commands is complemented by a similarly well-planned selection of formatting features. The Layout menu covers the following formatting options: Set Spacing, Start New Page, Alignment, Indented Point, Print Style, and Headings and Footings. Formatting commands are embedded in your text display, but the page replica on the status screen gives you a virtual representation of how each command will affect the final appearance of your printed document.

To give you a general idea of the power of Homeword's print formatting features, let's run down a few particulars. The Set Spacing menu, for example, lets you change top, bottom, right, and left margins as well as specify single-, double-, or triple-

## At a Glance

**Name:** Homeword

**Type**
Word-processing program designed for home use

**Manufacturer**
Sierra On-Line Inc.
Sierra On-Line Bldg.
Coarsegold, CA 93614
(209) 683-6858

**Price**
$69.95

**Format**
One 5¼-inch floppy disk

**Computers**
Apple II or IIe, Commodore 64; 64K bytes of memory and one disk drive required; IBM PCjr version available for $75 (IBM System Products Division, 1845 South Federal Highway, Delray Beach, FL 33444; (305) 241-7614)

**Documentation**
36-page user's manual, audiocassette tutorial, quick reference card

**Audience**
Home users interested in an easy-to-learn word processor for basic writing tasks

spacing. The Indented Point option is a clever formatting tool that makes it easy to design outlines or lists with nested indentations. Print Style lets you opt for boldface or underlined text rather than the normal style, and Alignment gives you the choice of setting your text flush left, flush right, centered, or justified. In short, Homeword offers enough formatting power to satisfy virtually any home user, and clear graphic icons facilitate learning and using the array of features.

While on the subject of Homeword's ease of use, we should mention the main menu's Disk Utilities option. Disk commands are collected here, for formatting and backing up disks, erasing documents stored on disk, or checking a disk's directory. Also, a warning message alerts you if you try to leave Disk Utilities without saving your current text.

### Help and Documentation

Although the simplicity designed into Homeword makes extensive documentation unnecessary, the program's developers did not skimp on helpful materials. For those who have trouble finding quick reference cards when they need quick reference, an on-screen help feature gives you immediate access to the guidelines printed on the card. The Homeword *Storybook* offers a leisurely rundown on all aspects of the system and even includes trouble-shooting techniques for dealing with confusing problems.

Nevertheless the most useful printed documentation is, indeed, the quick reference card, for it details command shortcuts using the Shift and Control keys. Once you're familiar with the program's operation, you'll want to take advantage of these shortcuts to avoid going through the menu options that were so helpful in the beginning but later seem tedious. Providing you with these options is an excellent way of balancing the needs of beginners with the preferences of more experienced users.

All in all, Homeword is a serious contender in an emerging class of inexpensive, easy-to-use, full-featured word-processing systems. Direct competitors such as Bank Street Writer and Wordvision may boast of more features for less money, but Homeword's unique icon approach distinguishes it from the rest. Sierra On-Line has recognized that logical design and ease of use are more important than sheer number of commands and so produced an exciting product at a reasonable price to fit that concept. Companion products featuring the same approach are now being developed.

If you're serious about word processing, you'll have to look elsewhere for italics, subscripts, horizontal scrolling, automatic hyphenation, and the like. But if you're looking for a way to prepare letters, memos, and short documents without the frustration often associated with traditional word-processing software, Homeword should fill the bill nicely. □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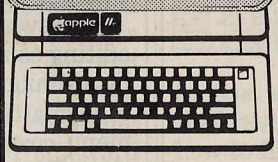

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*HOME*

# Inshape

*A record-keeping program for the health conscious*

by Michael Oppenheim

Inshape is a narcissist's delight. This record-keeping program accepts information about diet, weight, and exercise and feeds it back to you in the form of graphs and tables showing some aspect of your fitness profile.

You can store a year's worth of nutritional data on every meal and snack, all of which you can quickly call up, view in daily or weekly summaries, and graph. You can do the same with your weight and exercises.

From a scientific point of view, Inshape is impeccable. It makes no claims or promises that it's the gateway to a health and fitness Shangri La. If you're looking for a fitness plan that will help you drop a few pounds, Inshape is not what you need. Its purpose is strictly to keep records.

Inshape is useful and fun provided that you follow some kind of diet-and-exercise regimen (a reducing diet isn't essential); you religiously sit down every day and enter a mass of data about your weight, activity, and food consumption; and you enjoy contemplating how your body functions.

If you're this sort of person, Inshape's graphs and tables can show you at quick glance the relationship between such things as a hot fudge sundae and 10 miles of jogging. If you've been conscientious about data entry, a few keystrokes can produce a 60-day plot comparing calories consumed with your weight. A graph showing the number of minutes you've spent playing basketball each week during the past year is a snap. If you want to correlate your daily fat consumption with the number of miles you've rowed, jogged, bicycled, or cross-country skied, the program will do it.

Michael Oppenheim is a freelance writer living in Los Angeles, California, who also practices medicine.

### Easy Operation

Using the program is easy once you master the 68-page manual, a task that took me about an hour and a half. Except for a typo or two, the writers have done a good job, explaining in careful steps with numerous examples how to enter data and extract graphs and tables.

As a bonus learning aid, Inshape comes with a disk containing sample data that you load into the program. Supplementing the manual, this on-screen data illustrates the program's operation.

To begin, you first sign on with your name and the date. The screen then displays a calendar. Using the cursor controls, you can highlight any date for which you want to enter new data. Usually you want that day's date, but the entire past year is accessible. To move on, you press a function key from the list displayed at all times at the bottom of the screen. In this case, F1 equals diet, F2 is exercise, F3 weight, F4 plot, F5 daily summary, and F6 exit.

Pressing F1 gives you the diet menu from which you can enter, edit, or review your food data, conveniently divided into snack, breakfast, lunch, and dinner. If you're uncertain of the fat, carbohydrate, protein, or calorie content of any item, one keystroke brings up a 1000-item food dictionary with the numbers you need. Once you've entered all the data, another keystroke produces a neat daily summary of your nutritional profile. Inshape guides you just as carefully through exercises and weights (actual and target) and into the real fun: plots and graphs.

### You Need Dedication

Who needs this program? I've decided I don't. It's not that I don't care about health and fitness—I jog faithfully five days a week, and my diet is so natural and so low in bad things that friends long ago gave up inviting me to dinner. My problem is that I'm not very curious about my caloric intake versus expenditure or the nutritional composition of my diet. Jogging is healthful but boring. I don't like to think about it. And surprisingly, I don't know how many calories my diet contains or how much fat or protein or even (horrors!) if I'm getting enough vitamins. It's probably OK. Despite all you've heard, good nutrition is easy to achieve.

As a result of all this, I kept forgetting to enter my data. After skipping a day or two, it's hard to recall details and very tempting to fudge to fill in the gaps.

Early on, I decided my wife was a better candidate for the program. She jogs too, but unlike me she pushes herself farther each week. Having dropped 40 pounds over the past year, she is far more preoccupied with her diet and weight than I am.

After explaining the program's operation, I asked her to use it for a few weeks, then give me an evalua-

## At a Glance

**Name:** Inshape

**Type**
Fitness record-keeping program

**Manufacturer**
DEG Software Inc.
Suite 150, 11999 Katy Freeway
Houston, TX 77079
(713) 531-6100

**Price**
$95

**Format**
5¼-inch floppy disk

**Computers**
IBM Personal Computer, Compaq, and Columbia

**Documentation**
70-page three-ring manual

**Audience**
Health-conscious individuals who keep records of what they eat and how many calories they burn

tion. As an incentive I offered to share my writing fee with her. It sounded interesting, she said. She'd do it. Two days later I reminded her. Apologizing, she promised to get to it as soon as she found time. Several days later: another reminder, another apology. In the end I did the review without her help.

But negative results also have meaning. In this case they suggest that Inshape is for those dedicated souls conscientious about record-keeping. In fact, it might be excellent for body builders and athletes on a rigorous training program.

If you're an average health-conscious individual, hold off. Take this test first: buy a 49-cent notebook and record your weight, exercises, and every portion of every meal daily. If you can do this reliably for a month, buy the program. But keeping records like this is tedious. If you find it's not for you, then you'll have saved yourself $95. □

*DATABASE*

# Personal Pearl

*The world's your oyster with this mid-range database management system*

by Charles Spezzano

Many professionals and business people buy a personal computer with the hope that it will help them become more organized. Personal Pearl may be the key to fulfilling this wish. Readily accessible to computing novices, this database management program provides you with tools to organize, store, retrieve, and manipulate data in a variety of ways.

The software market is crowded with database programs at all levels of sophistication, with each best suited to a specific kind of task. Personal Pearl, which is designed to manage client and customer records for small businesses and self-employed professionals, falls in with what are generally defined as mid-range programs. More sophisticated than simple file management programs such as PFS:File, yet not quite as powerful as the full-featured systems such as dBASE II, programs in this category try to reach a happy medium between ease of use and power. Personal Pearl's step-by-step tutorials, on-screen menus, and excellent help text make this program easy to learn and use. And some of its data-relating capabilities give you a sampling of the flexibility found in some of the high-end systems.

Charles Spezzano runs SPCU (Society for the Prevention of Cruelty to Users), an IBM PC research project in Denver, Colorado.

### Welcome to Pearl

Personal Pearl assumes that you know nothing about storing and retrieving information with a computer and offers an easy entry into the world of powerful database managers. All you have to know to get started is whether your monitor is monochrome or color. Every section of the program leads you on by presenting an equally simple choice—design a form or enter data, for example. Help is all around you. When you begin creating forms and entering data into them, the lower portion of the screen displays the control-key commands. If that's not adequate help, the program's built-in Help function gives you on-screen explanations of any procedure.

The five step-by-step lessons in the Easy Tutorial introduce you to the basics of designing forms, entering data, and then designing and printing reports. Even though you are in effect creating your own custom data management programs from scratch, you do not have to know anything about programming, nor do you have to learn a special language. The logical English menus and commands are introduced in one of the best short tutorials I've seen. As well, the technical sophistication of Pearl is so well disguised that as you are designing forms and reports you are aware only of typing familiar words onto the screen.

### Creating a Database

Once you've been through the Welcome disk and tutorial, you're ready to begin designing a customized database. One of the first logical steps is to determine the categories of data you routinely collect in the course of doing business, such as customer names and addresses and tax-deductible expenditures. Next you decide on a format in which you will store that data on each form (also called records). For example, city, state, and zip code are usually written on the same line.

Now you define each data input area (also called fields). To do this you move the cursor to the first space in each data input area, such as client name, and press Ctrl-B. At this point, Pearl asks you four questions: the official name of that data input area; whether input in that field is mandatory; what type of data will be entered in that field (characters, numbers for computation, or date); and the formula for computing the number that will be entered in the field, when that is required.

Each field can be as large as the width of the screen and each form can contain a maximum of 250 fields. The complete form can be up to nine screen pages long. The only limit on the number of forms in a database is the capacity of your disk or 8 megabytes, whichever is reached first.

### Indexing

Once you've determined the layout of a form and defined the fields, you can identify any number of fields as indexes for finding records. Pearl consults the indexes you have created to find certain forms among all those stored in a database. Unless you indicate otherwise, Pearl will use the first field entered as the index.

In addition to identifying certain fields as indexes, you can tell Pearl

to recognize fields as "contact keys" or "path keys." In doing this, you tap into the real power of Personal Pearl—through a network of key fields one form can draw into itself data stored on up to nine other forms (with a 16-bit computer, or up to four other forms with an 8-bit system). Similarly, a report can incorporate information from 10 different types of forms.

With Pearl, you can browse through the other databases that are linked by a common field to an active form visible on your monitor. Data from these external sending forms can be inserted into the central receiving form and you can perform calculations on fields from those external forms to get a figure you need for the central one.

However, there are limits on the functioning of these pathways: they are one-way streets. Only one form at a time can read data into itself from the other forms with common fields. Because of this, Pearl lacks the ability to update a field in more than one file simultaneously, even if that field has been indexed on all the forms that contain it.

### Entering Data

It is easy to enter data once you've designed and installed a form. You choose the name of the form you need from an on-screen list of those you have previously designed, and Pearl displays that form on-screen with a menu of data input commands. You simply fill in the blanks next to each field name. The enter-data feature of Personal Pearl also allows you to edit or delete.

Even after you have entered and stored information on a set of forms, Pearl allows you to change the design of that form without loss of the original information. This update ability can be a life saver in a variety of situations as your business grows and changes in ways you could not have predicted at the start. And one of Pearl's file-maintenance utilities allows you to rebuild the index when you change the indexing of a form through redesign.

Other utilities are also worth getting to know. For example, if you delete records from a file, you can recapture the previously occupied space on the disk. Another utility reports on the number of records in a file and the amount of unused space on a disk.

### Generating Reports

For most users, the ultimate purpose of all this data organizing will be a printed report. Pearl can print labels, invoices, and other types of reports. You design your own reports using steps similar to those used in designing a form. The report might look exactly like the form or be completely different. Several reports can be associated with one form, or one report can pull data from several different types of forms. By selecting high and low ranges in a field, you can produce a report that includes only a subset of forms from a file. For example, if you have stored a set of forms that contain the dates of all your client appointments in 1983, you might specify a report that includes only records with a date range from 1/30/83 to 3/5/83.

Finally, Pearl asks you about the sort priority for arranging records in a certain order for your report. For example, you might want your mailing labels printed out by state, then by zip code, and finally in alphabetical order by last name of the client within zip codes. During the report-production process Pearl will ask you to insert the sorting disk to arrange your records in an order for printing. Data to be printed can be sorted on a maximum of five fields.

### Starter Library

Pearl comes with three programs that you can use straight out of the box or customize. The Appointment Calendar System contains a data-entry form and three reports. It can be used to create a complete calendar of your appointments, listing date, time, person, purpose, and comments.

The Cash Disbursement Journal System also begins with a predesigned data-input form that can be used to generate a report on the total history of your financial transactions (by check number, for example), and specific reports on tax-deductible expenses, expense distribution summaries by spending category, or a disbursement ledger that lists and totals all your payments to a particular person or business.

The People Information System is Pearl's version of the familiar Rolodex client or customer file and allows you to generate a list of mailing labels, a phone list, or a small personal profile on each client.

Overall, Pearl is a very impressive data manager. It performs smoothly, appears crash proof, handles errors well, has good documentation, and is easy to learn—an excellent means of transforming the random data of your personal, professional, and business activities into useful information. □

## At a Glance

**Name:** Personal Pearl

**Type**
Database management program

**Manufacturer**
Pearlsoft Inc.
POB 638
Wilsonville, OR 97070
(503) 682-3636

**Price**
$295

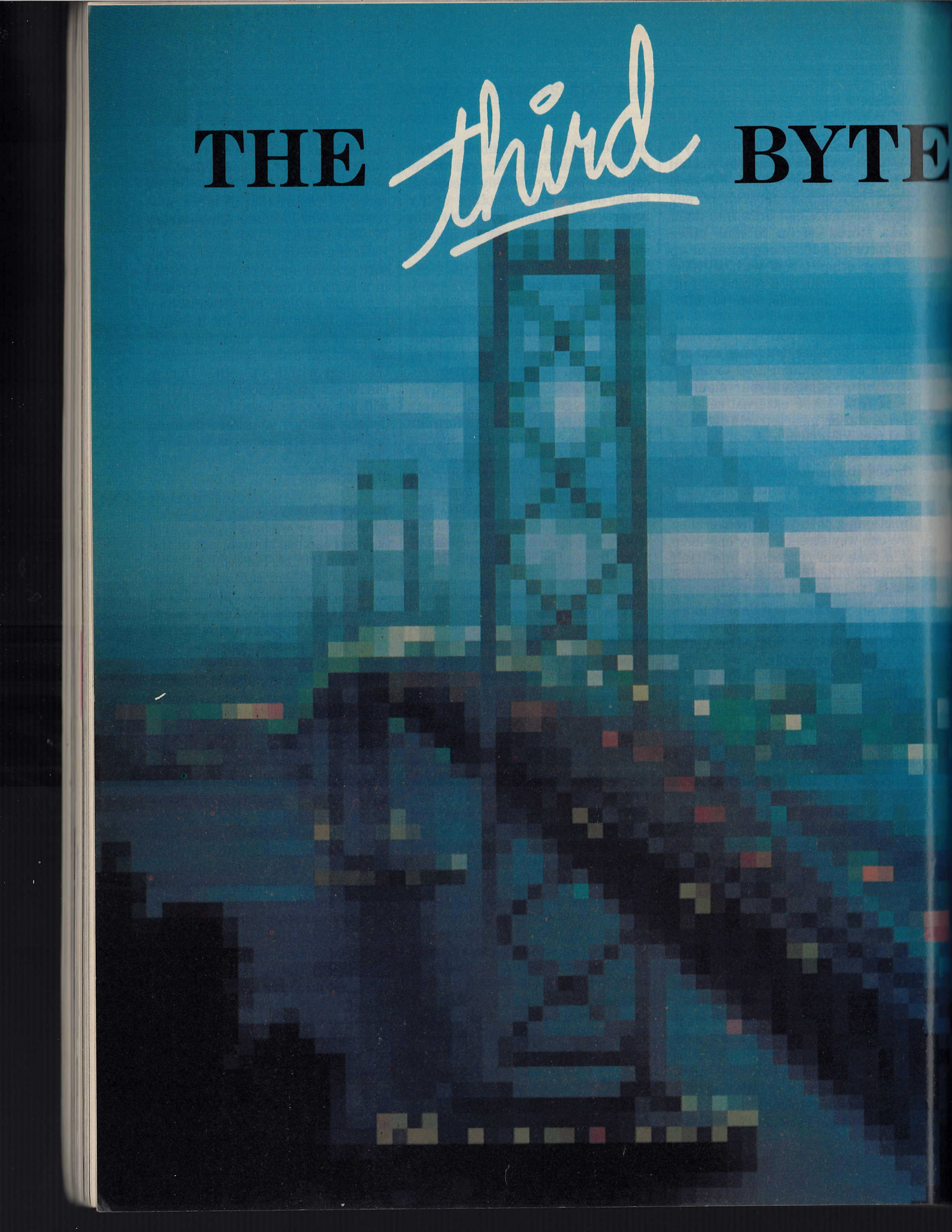
**Format**
Three to six 5¼- or 8-inch floppy disks

**Computers**
IBM PC and most compatibles with 128K bytes of RAM; most CP/M 2.2 systems (with 52K bytes of RAM), CP/M-86, and MS-DOS-based systems, Apple II and IIe with CP/M card

**Documentation**
A 400-page manual now includes both Easy and Advanced Tutorials, sample forms and reports, and reference guide

**Audience**
Small business owners and professionals who need to store client and financial information and retrieve it easily in a variety of report formats

**Options**
File Load Utility that lets Personal Pearl read other ASCII files, $100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POPULAR COMPUTING

*BUSINESS*

# Accounting Partner

*You'll find a number of powerful features in this four-module reasonably priced package*

by Errol Brown

Bookkeeping can be time-consuming and tedious—the kind of work you'd like to shove off on a partner. Star Software Systems, a California-based manufacturer, has just the partner for you. Called The Accounting Partner, it's a four-program package that contains a general ledger, accounts receivable, accounts payable, and payroll module. And this package could be just the thing for small-to-medium-sized businesses that use bookkeeping procedures matching those The Accounting Partner provides.

### The General Ledger

Designed to handle up to 400 accounts, the general ledger module should be sufficient for most small-to-medium-sized businesses. The chart of accounts is flexible enough to accommodate most accounting systems and does not lock you into standard account numbers or titles the way some ledger packages do.

After initializing the program, you create headings, titles, and total accounts for your initial chart of accounts. The program allows account numbers of up to six digits (four base numbers plus two for departments). You also set up account names, amounts, and budgets at the same time. This step could be improved, however, because after entering each heading you must return to a menu to enter each subsequent item.

You can enter transactions in the general ledger through cash receipts, check disbursements, or general journal entries. Each of these journals operates basically the same way. You can enter five amounts per screen and see the running balance displayed for each transaction.

The cash receipts and check disbursements journals allow the first line of each entry to be made to a bank account and automatically put into the proper debit-credit column. Offsetting entries are automatically posted to the proper debit-credit column but can be moved.

The process of entering journal transactions is slow, as is the sorting of transactions and printing of transaction registers. The program accepts out-of-balance transaction entries, although it displays a warning on the journal printout. The trial balance can also be run out of balance, creating a potential problem.

Most of The Accounting Partner's reports are designed to be printed on 11- by 17-inch paper and can therefore contain a wealth of information. (Star Software supplies the name of a forms supplier who can provide all the special forms needed with the program.) Reports available through the general ledger are a chart of accounts, general ledger account information listing, transaction registers, trial balance, statements of income, and balance sheet.

The general ledger accounts information listing reveals a lot of information not usually found in a single report. It lists all current values of the chart of accounts, including all month-to-date, quarter-to-date, year-to-date, previous-month-to-date, previous-quarter-to-date, previous-year-to-date, and budget amounts.

You can print the transaction registers in order by date, account number, or journal entry. Four income statement formats are available: current month and year; current month, quarter, and year; current month, quarter, year, and budget; and current month and year, last month and year. Missing, however, is a comparative income statement with the previous year's amounts, a statement that many businesses use quite often. You can produce income statements for the entire company or for each department. Percentage columns are available on each type of income statement for use in statement analysis. The balance sheet is standard, with amounts printed in a three-column format. As with most other microcomputing accounting packages, a statement of funds flow report is not included with this package.

### Payroll

The highlight of The Accounting Partner is the payroll module, which contains features not found in many of the more expensive accounting packages. Federal tax liabilities and tax deposits by month are listed on the 941 form and also on a separate federal tax deposit report, showing all the information you need for

Errol Brown is the data-processing and accounting-services manager for Den Hartog & Hogan, a CPA firm in Waterloo, Iowa.

## At a Glance

**Name:** The Accounting Partner

**Type**
Accounting package: general ledger, accounts receivable, accounts payable, and payroll modules

**Manufacturer**
Star Software Systems
20600 Gramercy Place
Torrance, CA 90501
(213) 538-2511

**Price**
$395

**Format**
5¼-inch floppy disks

**Computer**
Any CP/M, CP/M-86, MS-DOS, or PC-DOS 8- or 16-bit computer; requires a minimum of 64K bytes of random-access memory (RAM), two floppy-disk drives or hard disk, 24 by 80 video display with cursor addressing, and a 132-column printer; 16-bit system requires 128K-byte RAM

**Documentation**
Loose-leaf binder with approximately 650 pages, including system overviews and sample reports

**Audience**
Businesses with annual sales up to $5 million who want to improve their accounting systems

systematic reporting to the IRS.

Payroll records include current, month-to-date, quarter-to-date, and year-to-date totals of various wage and tax categories. Payroll checks and W-2 forms, of course, can also be printed with this program.

The Accounting Partner takes a different approach to federal and state payroll tax tables than most accounting packages use. Most software developers build tax tables into the program and then offer revisions as tax laws change and necessitate new rate tables. The Accounting Partner requires that you build your own tables. At first I questioned this approach, but after entering the federal tax tables I found the procedure easy to do with very little time involved.

The payroll system handles the normal federal and state as well as local tax deductions. The program also accumulates employee sick time and vacation time and tallies departmental totals for various company breakdowns, a source of valuable statistical information.

You can access employee records by employee last name or number, using the number if two employees have the same last name. You enter the hours worked on the time-card input screen, along with bonuses, commissions, or other miscellaneous income items which are added to gross pay when the program calculates the payroll taxes.

During payroll calculation, you can display each paycheck on the screen if desired. If an error occurs during this phase, you can run the temporary payroll register, make the necessary changes to the time cards, and run the calculation phase again. Payroll checks can be reprinted as long as employee pay history has not been updated. But once updated, the current time cards and paycheck files are erased. The payroll check register must also be printed before updating, or information will be lost.

Other reports available with the payroll module are employee list, employee pay history, 941 schedule, employer tax deposit history, and payroll register. The employee pay history is cumbersome to use because you must access each item individually rather than filling in a full screen of information at once.

The payroll module accommodates approximately 130 employees on a 5¼-inch double-sided double-density disk. Because the program uses two disks, you'll find yourself occasionally shuffling the two disks in and out of the drives.

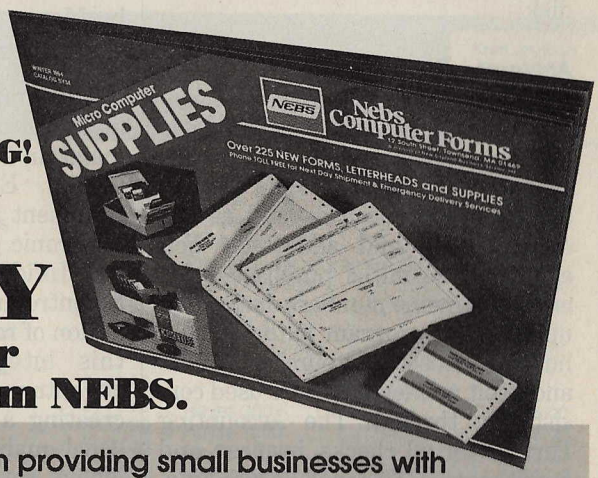
### Accounts Receivable

The Accounting Partner's accounts receivable program accommodates the balance-forward method of accounting but not the open-item method.

The accounts receivable module offers a unique feature that lets you set up customer file default values to speed up the entry of customer account information. Once you've set these values, you merely press the return key to enter that information. Even better, simply press the control key and a letter, and the program automatically fills in a complete section by default.

Aged customer account balances are entered when you set up the original customer file, a timesaving feature when you consider that most accounting packages require you to do this in two steps. You can also establish an item file to speed up the order-entry process with the program's automatic look-up feature. Each item can accommodate up to five different prices to allow for both retail and wholesale pricing.

The accounts receivable program is also designed to create invoices, statements, and credit memos on special forms. The program's invoice feature can automatically produce an invoice for specific customers each month. The program can print invoices and credit memos for all accounts, for a single account, or beginning with an account you specify. Invoices and credit memos can be re-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printed if the information has not yet been deleted.

Customer statements that summarize the month's activity can be produced at any time. The statements do not reflect aging of balances due from customers, a weakness I think should be corrected to aid in account collection. Customer statements can be reprinted until information is deleted from the system. If you want, you can add finance charges to customer balances.

Reports available from this module include customer listing by account number or in alphabetical order, customer status reports and aging reports in numerical or alphabetical order, and item-file listings. The accounts receivable program should handle approximately 150 customers with 125 items, assuming three invoices per customer per month and one payment and credit memo per customer per month, on each 5¼-inch double-sided double-density disk.

**Accounts Payable**

The accounts payable module prepares purchase orders and debit memos on special forms. The vendor account setup contains aged account balance information as well as the usual names and addresses. You establish the initial purchase-order and debit-memo numbers during setup, and the program automatically numbers subsequent purchase orders and debit memos, a feature used consistently through The Accounting Partner for all checks, invoices, and credit memos. This module also automatically handles amounts paid on a monthly basis.

As is the case with the accounts receivable module, you can print purchase orders and debit memos in their entirety, for a single account, or a partial list beginning with a specific account. You can also reprint them, but the documentation advises you to delete purchase-order details periodically to conserve disk space.

Reports produced by the accounts payable module include vendor listing by account number and in alphabetical order, vendor worksheet (showing detailed transactions for a month), and vendor status and aging reports in numerical and alphabetical order.

This module should handle about 150 vendors with 125 items, assuming three purchase orders per vendor per month and one payment and debit memo per vendor per month.

**The Bottom Line**

In The Accounting Partner, totals from the accounts receivable, accounts payable, and payroll modules cannot be transferred automatically to the general ledger module. You must calculate figures from the journal totals and enter them into the general ledger module in the form of general ledger journal entries. Most of the more expensive accounting packages can automatically transfer totals between modules, but I don't consider the lack of this feature a serious drawback to The Accounting Partner. The time involved in posting three general journal entries once a month is trivial.

The Accounting Partner should make a good starting package for many small-to-medium-sized businesses just getting started with a microcomputer. If the package fits into *your* accounting system, these four complete accounting modules with documentation for a total cost of $395 are quite a bargain. □

*GAMES*

# Infidel

*An archaeologist antihero searches for a lost pyramid*

by Monte Schulz

In the constantly evolving world of microcomputer gaming, for a manufacturer to do no more than maintain a status quo means falling behind. Each new release must represent an advance in the art of electronic gaming.

In Infidel, author Michael Berlyn has introduced a curious twist to the notion of role-playing. He has taken this integral element of text-adventure games a step forward by creating a "hero" of dubious personal qualities. He's a character we dislike yet are forced to adopt the moment we begin playing. Thus the notions of hero and villain become blurred, and winning or losing becomes purely subjective, resting entirely in the eye of the beholder.

In Infidel, you assume the part of an archaeologist driven by yearnings for grandeur and motivated by the once-in-a-lifetime opportunity of discovering, and presumably pillaging, a long-lost and forgotten Egyptian pyramid. Success will not be easily attained, however, because you have conned and bullied your way into this position, lying to your financial backer and pushing your hired help to the point of no return.

As the game begins, you are just awakening from a drug-induced sleep brought about by the workers you have so mercilessly hounded and abused in your obsessive search for the mysterious pyramid. You get up from your cot, look around, then leave your tent to find the camp ransacked and emptied of all but a few tools. Wonderful! The sun is beating down, and your foreman and workers have gone the way of your luck. Alone, you now must find a way to manage the obsession that has drawn you to this place. There's a droning in the air. You look up. A plane is circling overhead, a cargo plane perhaps carrying the navigation box you've been waiting for to help locate the pyramid in the seemingly endless desert. It occurs to you that you might not need anyone after all. Maybe you never needed anyone. And maybe now, if you can find the entrance to the dead queen's tomb, you won't even have to share

Monte Schulz is a freelance writer who lives in Santa Barbara, California.

the rewards. But the sun is not getting any cooler and your mouth is becoming awfully dry ...

Infidel has the feel of an old pulp or a Saturday matinee adventure reel: the same sort of excitement that inspired Steven Spielberg and George Lucas to write *Raiders of the Lost Ark*. Infidel demands of the player no special knowledge or previous familiarity with either Egyptology or state-of-the-art computer adventure games. Ample and well-crafted descriptions of your surroundings add to the fun of the play. You can go off on various side trips that have no connection with solving the game but which add to the drama. You have to be careful, though; sometimes journeying off on these tangents can be dangerous. Go ahead, wander off in the desert toward the Equator—you'll see what I mean.

### Skill and Luck

Infidel has essentially three levels of play. The first, the survival phase, takes place quite obviously in the desert. You gather your tools and supplies, then use them to locate the pyramid, or die in the process. Second-level action takes place within certain areas of the pyramid. Mapping and translating the strange hieroglyphics as you go (not strictly necessary but definitely suggested), you must solve the secrets of the immense tomb before you can advance to the final level. Then, it is within the tomb's antechamber that the game becomes most difficult. To reach the point where the queen's sarcophagus is ready to be opened requires cleverness, a certain amount of tact and imagination, and, as is usual in most games of any type, either good old dumb luck or efficient use of that favorite standby: trial and error.

The relative difficulty of any adventure game must, of course, remain subjective. What might be a breeze to one player can turn another inside out with frustration. Nevertheless, Infidel is certainly not one of Infocom's harder games. But this is not really a criticism. Indeed, its puzzle structure is probably the most accessible of any found in Infocom's many universes precisely because only in Infidel do the problems seem rooted in the real world.

A typical Infidel problem is the puzzle of the sliding walls in the circular room. Standing at the center of the room beside a statue of an Egyptian queen, you see four passages leading to the northwest, northeast, southeast, and southwest. Finding nothing of obvious interest about the statue, you walk up the northeast passageway. As you reach its end, a massive door, previously suspended in the ceiling, slides down to block entrance to a room beyond. You try to pull it open but fail miserably. In disgust, you head back down the passageway to the southwest. As you reach the end of this corridor, not only does the wall slide down before you, but as it does you notice that the door to the northeast has opened again. Interesting.

There is no magic in Infidel, no fantasy or science-fiction problems to unravel. If anything, the problems are ones of engineering and common sense: almost the kinds of puzzles one might find in a textbook or a game magazine. And they are puzzles that are fun to work on, even if their solutions are not so obscure and demanding as those found in other games of this type.

### Details Add Realism

But what Infidel may lack in sheer difficulty it makes up for in attention to detail and uniqueness of concept and plotting. This game contains some beautiful area descriptions, particularly in the Temple and Circular Room sections where the light from your torch illuminates ancient wall paintings and relief sculptures inlaid and colored with precious stones and exotic dyes. Infidel comes to life through this kind of detail.

If there is anything disconcerting


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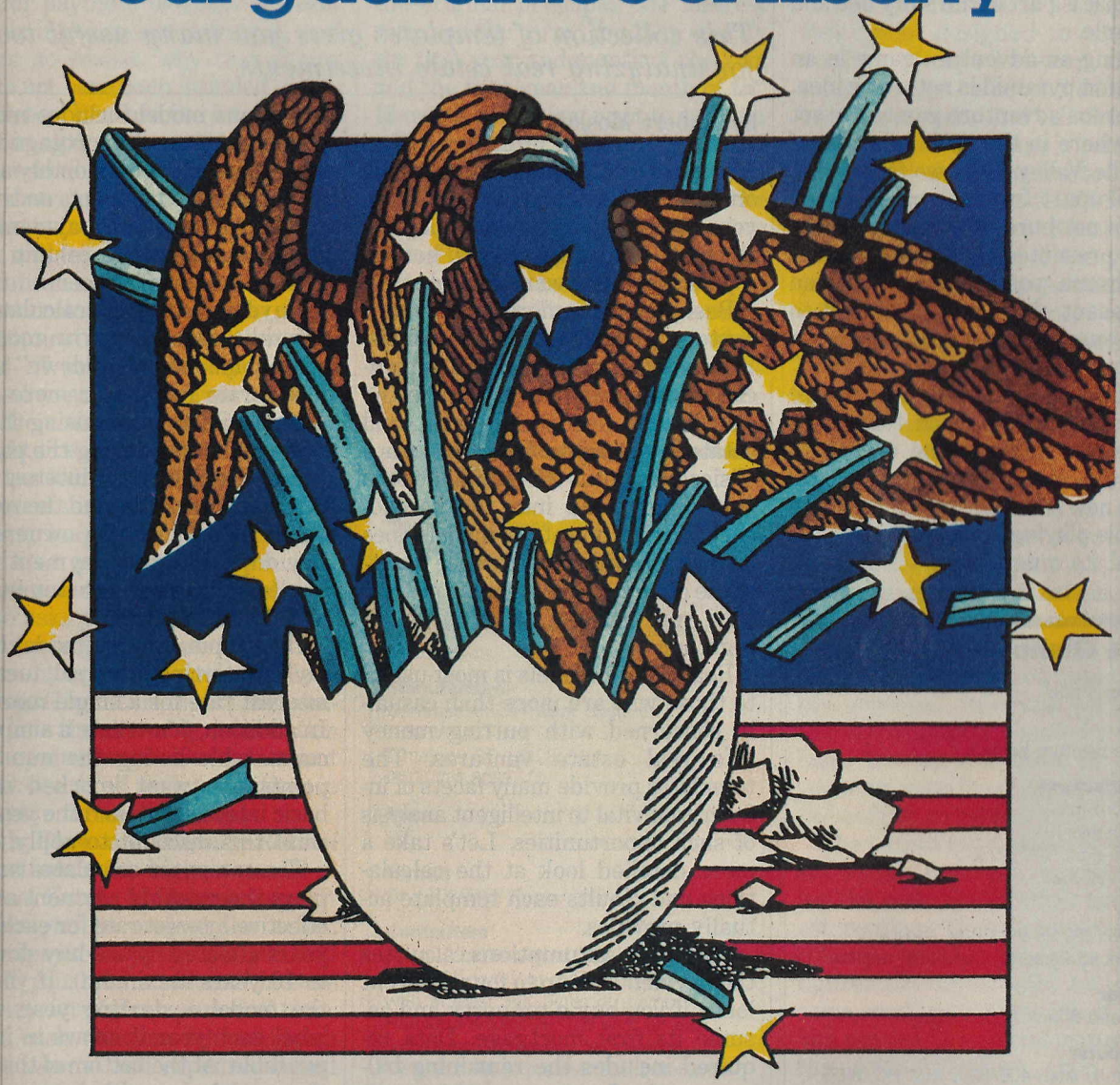

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in the game it is the absence of other characters with whom to interact. But, then again, 3000-year-old tombs are not lively places and the emptiness and solitude are integral to the development of the plot. If you feel isolated out there on your own, well, that is part of the story line and your role.

Setting an adventure game in an Egyptian pyramid is not a new idea. Numerous adventure games are set somewhere in the shifting sands of the Nile Valley. But two factors set Infidel apart from the others. Your hero is not pure white. Almost like being presented a villain's role in a melodrama, you are thrown into an unpleasant situation and forced to reap your just rewards, whatever they turn out to be. And you "win" in Infidel only insofar as you are clever enough to reach that point where you're given the chance to read the last page of the script. These new concepts in game plotting and role playing are what really give Infidel its uniqueness. □

### At a Glance

**Name:** Infidel

**Type**
Text adventure game

**Manufacturer**
Infocom Inc.
55 Wheeler St.
Cambridge, MA 02138
(617) 492-1031

**Price**
$49.95; $59.95 for CP/M and NEC Advanced Personal Computer versions

**Format**
5¼- and 8-inch floppy disks

**Computer**
Apple II, Atari 400/800, IBM PC, NEC PC-8000 and Advanced Personal Computer, TRS-80 Models I and III, Commodore 64, Osborne 1, TI Professional, and CP/M-based systems with an 8-inch disk drive; requires 32K bytes of RAM and one disk drive

**Documentation**
Game manual, journal, letter, map for locating pyramid

**Audience**
Adventurists ready for a role-playing challenge

*BUSINESS*

# Real Estate Models for the Eighties

*This collection of templates gives you many useful tools for analyzing real estate investments*

by Robert Moskowitz

If you are comfortable with Visicalc or Lotus 1-2-3 but too busy with your day-to-day real estate business to create your own models, here is a package you'll want to look at.

Basically, Commercial Software Systems' Real Estate Models for the Eighties is a collection of 16 financial models designed to handle the calculations needed for wise real estate investments. Each model is a Visicalc or Lotus 1-2-3 data file that you simply load into the spreadsheet. Every one of the models does its own job without reference to any of the others; in fact, there is no easy way you can get them to work together.

Real Estate Models is most useful to those who are more than casually concerned with putting money into real estate ventures. The templates provide many facets of information vital to intelligent analysis of such opportunities. Let's take a more detailed look at the calculations and results each template actually provides.

**Mortgage Assumptions** calculates the payments on up to four different loans if you buy a property and assume its first mortgage. Data required includes the remaining balance on the first mortgage, interest rate, and starting year. You also have to specify any secondary financing you put or contemplate putting on the property. A clever "balance check" compares your secondary financing with the amount of the sales price not covered by your down payment and first mortgage balance. This model also accepts input of the points and fees you'll have to pay.

Output from the Mortgage Assumptions model includes monthly payments on each mortgage for up to 27 years and total monthly and annual mortgage payments on the property. Any balloon payments are shown in a separate column in the year you must pay them.

**Buydown Analysis** calculates the monthly payment on a mortgage after someone "buys down" the interest rate for one or more years. Home builders began using the buydown technique during the past few years after sky-high interest rates put their homes beyond the reach of many potential home owners. The buy down is a cash payment to the lender in return for temporarily lower interest rates.

Data input for this model is simply the starting principal, term, and interest rate for a single mortgage. In addition, you create a simple discount table listing the number of points you want knocked off the basic interest rate and the years you want this discount to apply.

The computer calculates and displays the monthly payment and the effective interest rate for each of the years affected by the buy down (up to 10 years maximum). If you give the model a starting year, it will label each year it shows in its output table. At the bottom of this table, the model shows the payment required to secure the lower interest rates you specified.

**Component Calculator** is a relatively fast and simple template that accepts four types of input. By using the appropriate one you can calculate principal, interest, term, or payment on virtually any loan.

You can use this model for more

Robert Moskowitz is a business consultant living in Woodland Hills, California.

than just real estate loans, of course. But because the calculations include both principal and interest, the template works only for amortized loans—those with no balloon payment of the principal at the end.

Other models in this series provide for payment of either interest only or interest and principal, and there's no reason why that choice should not have been included in this model, too. Because the interest calculation alters the model itself, you must reload it fresh from the disk each time you want to calculate an interest rate from the principal, payment, and term. The other three calculations can be worked many times without reloading them.

**Comparative Depreciation** is a model of interest mainly to real estate investors who want to know how their choice of accelerated or straight-line depreciation will affect their tax liabilities. This model simply accepts input on the cost of the property in question, the number of years over which it will depreciate, and the acquisition month and year. It also asks you to specify whether the property qualifies for special treatment as low-income subsidized housing. Given this input, the computer lists the allowable depreciation and the remaining basis (the amount not yet deducted as depreciation) in each year for each method.

**Cash Flow and Equity Return Projection** is the biggest model in the Real Estate Models package. It enables you to project the actual cash expenses and income you will have if you hold a piece of income property for a given period of time.

The cash flow model calculates future income and expenses based on straight-line increments over today's figures. The model's output covers income, mortgage payments, taxes, expenses, and net cash flow for each year of the calculation. It also calculates both an internal rate of return (IRR) and an arbitrary sales price based on the last year's cash flow and the "capitalization rate" you previously keyed in.

**Amortization Detail** is a model that offers a good solution to the need for amortization data without the long wait for full calculations. Among other details, the model will tell you the monthly payments during any 12-month period of a mortgage or other installment loan.

The only data items required are the original principal, the interest rate, and the term. You then specify the first year and month of the loan and the first year and month of the 12-month period you want to examine.

The computer will quickly display a table showing the payment amount, the year and months of the 12 payments, the principal before and after each payment, plus the principal and interest portions of each payment. It also displays totals for the interest amounts, principal amounts, and the combined amounts of the payments made during the period. The table concludes with the amounts of principal and interest paid through the end of the period and the percentages these payments represent of the full amounts scheduled to be paid over the life of the installment loan.

**Date Calculator** is a simple and fast model designed to count the number of days between any two dates, calculate a second date based on various data, and tell the day of the week for the date it calculates. The calculations are limited to the years between 1901 to 2009.

**Internal Rate of Return** is a theoretical measure of the yield or payback on any investment. It's most useful for comparisons between different uses of your money.

To calculate the IRR, you simply enter a series of cash flows—payments you make or that are made to you—and hit the ! key. The model works rapidly to provide a single output figure expressed as a simple percentage: the internal rate of return for the cash flows you specified.

**Summary Amortization** calculates a list of the annual statuses of a loan from the beginning to the end of its life. The data you enter is simply principal, rate, and term, plus the starting month and year of the loan. You can also enter the month you start your fiscal year if you want the output to reflect this.

The output table shows beginning and ending principal, payments during the year, the principal and interest portions of the payments, and column totals. Normally, yearly figures are acceptable for all but some small part of the life of a loan. You can get the overall picture with this summary chart, then expand any one year with the Amortization Detail template explained above. This two-stage approach eliminates much of the calculation time that 30 years of monthly figures would require.

**Other templates** analyze creative financing methods such as shared equity, growing equity, and variable rate wraparound; supplementary financing techniques; and some basic tax considerations.

## At a Glance

**Name:** Real Estate Models for the Eighties

**Type**
Visicalc or Lotus 1-2-3 templates for real estate financial planning and current calculations

**Manufacturer**
Commercial Software Systems
7689 West Frost Dr.
Littleton, CO 80123
(303) 761-8062

**Price**
$65

**Format**
One 5¼-inch floppy disk

**Computers**
Apple II or IIe with DOS 3.3 and at least 48K bytes of memory, Apple III with at least 96K bytes of memory, Hewlett-Packard HP-125 with at least 64K bytes of memory (all running Visicalc); IBM Personal Computer with at least 64K bytes of memory running Visicalc or Lotus 1-2-3; one disk drive required

**Documentation**
45-page typeset loose-leaf manual

**Audience**
Reasonably sophisticated investors or professionals already familiar with Visicalc or Lotus 1-2-3 who need a tool for any of the larger, more complex real estate ventures, including building management and mortgage refinancing

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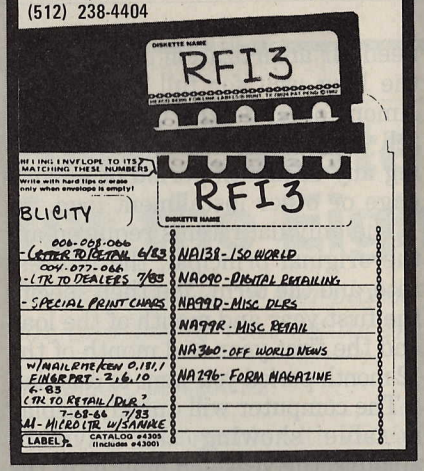


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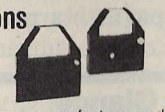

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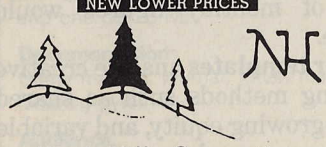

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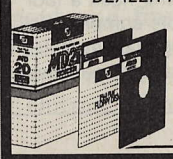

**INTRODUCTORY OFFER**

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The Real Estate Models package doesn't cover tax considerations as much as you might expect. The reason, according to template author Greg Glazer, is that tax aspects of real estate are normally tied up with other factors outside the real estate deal. Because the many possibilities and complexities make it impossible for any single package to cover them all, Commercial Software gives you simple, stand-alone models that allow enough flexibility for you to customize the standard templates or create your own models as needed.

### Not for Beginners

Real Estate Models is not ideal for beginners. The models have some deceptively simple input and output parameters, but in between them are very sophisticated calculations developed from accounting texts, mortgage banking principles, and accumulated experience. Some of the models use advanced techniques that provide for such functions as automation iterations (repeated calculations), something which until now has been thought to be impossible on Visicalc.

If you have the patience to look into the workings of a model, you can learn a lot about how to use your spreadsheet. But the software package is not intended to be a teaching aid—it lacks in-depth documentation. The 45-page manual generally gives very short explanations of obvious instructions. There are no explanations of the calculations, no hints on advanced applications, no instructions for moving data from one model to another, and no maps giving the coordinates for the entry of various data.

Overall, however, this is an impressive package that is well worth its very reasonable price. If you view the models as a basic framework in which to calculate real estate transactions and understand that you will probably want to modify and improve them to suit your particular needs, you'll find The Real Estate Models a great value and a useful addition to your library of Visicalc or 1-2-3 tools. □

# Unraveling the Unix System

*Recent books finally fill the need for guides to this sophisticated system*

**Unix Primer Plus**
*Mitchell Waite, Donald Martin, and Stephen Prata*
*Howard W. Sams, Indianapolis, 1983*
*416 pages, softcover $19.95*

**A User Guide to the Unix System**
*Rebecca Thomas and Jean Yates*
*Osborne/McGraw-Hill, Berkeley, CA, 1982*
*508 pages, softcover $17.95*

**Introducing the Unix System**
*Henry McGilton and Rachel Morgan*
*Byte Books/McGraw-Hill, New York, 1983*
*576 pages, softcover $19.95*

**The Unix Programming Environment**
*Brian W. Kernighan and Rob Pike*
*Prentice-Hall, Englewood Cliffs, NJ, 1984*
*368 pages, hardcover $26.95, softcover $19.95*

Reviewed by Mike Nicita and Ron Petrusha

Illustration by Henrik Drescher

In the high-kicking chorus line of the microcomputer industry, the one dancer who can never quite keep in step is book publishing. The publication of clear, comprehensive books on machines or operating systems always lags behind consumer acceptance, and until very recently books on the Unix operating system were a perfect example.

The books reviewed here cover a wide spectrum of topics and potential audiences. We begin with the elementary *Unix Primer Plus* and work our way to an advanced treatment coauthored by Brian Kernighan (a writer already well known to most Unix users and C programmers) and Rob Pike. Another book that deserves mention is *Understanding Unix: A Conceptual Guide* (Que, 1983), which is covered in this month's Micro Reviews. Readers who are interested in a purely conceptual introduction to Unix will find that volume sufficient. But for those who want to learn about an operating system in practice as well as theory, *Unix Primer Plus* is the place to start.

This beginner's guide to Unix provides a taste of the operating system's power and flexibility. Although only 60 of Unix's 200 commands are covered and little attention is given to general programming features (such as debugging tools or the Programmer's Workbench), *Unix Primer Plus* does convey an operational understanding of the system. Taking the concept of primer literally, the book intentionally omits higher-level details with the assumption that the serious reader will be moving on to more comprehensive volumes.

Anyone who has ever read one of Mitchell Waite's primers will immediately recognize the approach: graphics and cartoons are used to introduce the various commands and

Mike Nicita and Ron Petrusha are coauthors of *The Reader's Guide to Microcomputer Books* (Golden-Lee, 1983).

functions the book presents, and lessons are reinforced through hands-on examples. Although these examples use the C shell conventions of Unix, they can be transferred easily to a Bourne shell system (we used *Unix Primer Plus* on a Bell Labs system with little difficulty). All in all, the book is one of the most reader-friendly Unix introductions in a literature rarely noted for clear, simple text.

The authors gently guide you through the sometimes confusing maze of Unix commands. From the first log-on procedure through elementary editing, file handling, and system-configuration commands, topics are developed gradually. At each step of the way, the book's structure fits nicely with the design of the operating system itself. Users of version 2.0 of MS-DOS, for example, will find in the explanation of Unix's directory commands a section on pathnames and hierarchical structure as pertinent to their own operating system as to Unix. The authors give special attention to Unix's screen editor (as opposed to the line editor) and to some notable Berkeley enhancements such as the history, alias, and job commands.

*Unix Primer Plus* is an outstanding example of the "less is more" approach. By concentrating on only the most important aspects of a complex operating system, the authors have conveyed an elementary understanding of the essentials of Unix.

**Spotty Coverage**

To cope with the complexity of Unix and its multiplicity of commands and parameters, Thomas and Yates in *A User Guide to the Unix System* have considerably narrowed and condensed their subject. This approach is at least defensible when applied to Unix commands, but when it is extended to the operation of individual commands or to the use of the operating system as a whole, the reader's sense of coherency is threatened.

In their hands-on approach to learning Unix, the authors have selected the 40 most commonly used commands in Version 7 (the Bourne shell). A nine-session tutorial on basic Unix features (such as logging onto the system, using ed, and manipulating files) precedes the lengthy chapter devoted to the 40 commands, which explains each command and its error messages. This approach does enable the reader to build a rough vocabulary of Unix commands.

But that vocabulary comprises a limited repertoire. For example, the authors look only at ed, Unix's basic system editor; they exclude sed (the stream editor), ex (the extended basic editor), and vi (the popular screen editor). While the selection of commands curtails the user's ability to apply Unix flexibly, so too does the book's organization, which lists individual commands alphabetically within a given category.

Being able to use an operating system effectively requires not only a knowledge of available commands and their syntax, but also a familiarity with the functions of these commands and with the character of the operating system as a whole. This is the weakest point in *A User Guide to the Unix System*. At the level of the individual command, the excessive reliance on syntax multiplies the facts to be remembered while obscuring the logic behind them; for example, there is no explanation of why the cat command can either display the contents of a file or concatenate files. The authors devote too little attention to describing system features—hierarchical directories, for instance, are never adequately explained. And at the most general level of the operating system as a whole, the character of Unix as a multiuser, multitasking operating system is noted only briefly in the introduction, where it can easily be overlooked.

*A User Guide to the Unix System* fails to establish a suitable method for presenting the large and diffuse collection of details necessary to an understanding of Unix. We advise the beginner struggling to learn the operating system to look elsewhere for published assistance.

**A Textbook Approach**

*Introducing the Unix System* offers a traditional textbook-style approach to explaining the use of the operating system. For newcomers to Unix at all levels of experience, this thoroughly detailed, well-organized treatment is extremely effective.

The opening chapters introduce basic Unix procedures such as logging on and using the keyboard as well as covering the Unix file system and the basic commands needed to use it. The book then turns to more specialized applications: user-to-user communications, creating text with all four of the Unix editors, formatting documents, programming, and software development. While the book focuses on Version 7 of the system, one chapter discusses the Berkeley C shell. The final chapter treats Unix system management, a topic of interest primarily to the sophisticated user.

Authors McGilton and Morgan have not concentrated merely on the syntax of commands and their associated parameters. They also focus at length on the rationale behind these commands and their common pitfalls. The treatment of this latter topic offers ample testimony to the book's high quality: instead of simply listing error messages, the authors describe almost all problems likely to arise during actual use of the system. The book is also ideally organized for hands-on practice and instruction. McGilton and Morgan seem to have a special talent for presenting a new command or feature at the precise moment it is needed, which is, of course, the instant when the reader can most easily assimilate the new information.

*Introducing the Unix System* does suffer from some of the limitations of traditional textbooks. At times, the book is almost maddeningly detailed. For example, few readers will be interested in learning about the erase and line-kill characters for archaic Teletype systems. The book would be more effective if such details had been replaced by pictures of monitor prompts or a Unix command summary.

But throughout the book McGilton and Morgan display their dedication to popularizing Unix, their extensive experience with the system, and their serious commitment to teaching. These qualities make *Introducing the Unix System* an excellent work for all novice users.

**For Experts Only**

Unix was originally conceived to give programmers a comfortable, efficient environment for software development. Coauthors Rob Pike and Brian Kernighan begin *The Unix Programming Environment* at the point where the other books we've reviewed leave off, thus furnishing an advanced text on using the unique program development tools that Unix provides.

*The Unix Programming Environment* is aimed at programmers with some experience in C. The first five chapters provide a deeper understanding of the operating system than what you get from more popularized treatments. The second half of the text is Kernighan and Pike's version of a combined programming style manual and Unix showcase. Given the authors' Bell Labs background, it is understandable that the book treats the seventh edition of the Bell Labs Unix system. The detailed, condensed presentation of this material means that this is not a novice's guide—in fact, unless you have access to both volumes of the Unix Programmer's Manual and a Unix system running the Bourne shell, the book's instant acceleration may leave you in the dust.

Once you make it past escape velocity, though, you'll find an illuminating insider's tour of Unix. The early operational survey of obligatory topics like the hierarchical file structure and file creation and manipulation leads to a discourse on some of the system's more esoteric features. The authors' analysis of INODE files, for example, will clarify the ls command for every college student who ever used Unix to list the contents of a directory. And if the section on the pattern-scanning sublanguage called awk seems incredibly detailed, it may be because Kernighan is its codesigner.

In the chapters that address Unix programming tools, many of the program examples are themselves helpful utilities not included in the Bell seventh edition. One large program that creates a programmable calculator demonstrates these tools, and the final chapter examines the typesetting capabilities of Unix documentation-preparation software.

Kernighan and Pike's text is challenging even for the experienced programmer, but its lessons, both in shell and C programming and in optimizing built-in Unix development features, are rewarding.

Given the volumes we've covered here, we can conclude that the lack of Unix guides we mentioned at the outset is now being answered. Readers interested in exploring the nature, capabilities, and techniques of this powerful and unique operating system will at last find some truly helpful texts to make their venture easier and more satisfying. □

# MICRO REVIEWS

by Mike Nicita and Ron Petrusha

## Understanding Unix: A Conceptual Guide

*by James R. Groff and Paul N. Weinberg*
*Que, Indianapolis, 1983, 233 pages, softcover $17.95*

The power of Unix is simultaneously a drawback. By including some features of high-level languages, its creators have crafted an operating system that is unruly (with over 200 commands), hard to remember (commands bear little relationship to the functions they perform), and difficult to document. *Understanding Unix* is one of the first published works to address these problems by providing a solid conceptual overview of the multiuser operating system. While the book appeals to those thinking of selecting Unix as well as to those learning to use it, *Understanding Unix* is not an operations manual. Groff and Weinberg do examine select Unix commands and utilities, but their more general emphasis includes the structure of Unix, its suitability for given applications, and its flexibility within a multiuser environment. Although the reader will eventually have to fill in the blanks by reading a more detailed text, *Understanding Unix* lays a solid foundation for eventual mastery of an operating system whose flexibility comes at the price of considerable complexity.

## The Plain English Repair and Maintenance Guide for Home Computers

*by Henry F. Beechhold*
*Simon & Schuster, New York, 1984, 265 pages, softcover $14.95*

"The computer is really just a clever electrical appliance, one that doesn't take an M.I.T. graduate to fix," proclaims Henry Beechhold (in plain English). His book proves this by demonstrating simple repair techniques and imparting a rudimentary understanding of microcomputer electronics. In his introduction, Beechhold makes it quite clear that he is not suggesting that anyone (even an M.I.T. graduate) deliberately violate the warranty that covers most computers. If anything, extreme caution is his most basic tenet. Once past both the warranty's expiration date and the book's introduction, however, the apprentice repair person is in for a fascinating, entertaining time. Beechhold's lengthy explanation of each of the tools used in microcomputer repairs also serves as a format for introducing basic electronics concepts. The rest of the book uses these physical and conceptual tools to tackle the problems most commonly encountered by microcomputer users—from removing foreign matter from a keyswitch to replacing a blown fuse. Every microcomputer user even slightly interested in adding a new dimension to his or her under-

standing of microcomputers should read this book for its wealth of information.

## Presenting the Macintosh

*by Merl Miller and Mary Myers*
*Dilithium, Beaverton, OR, 1984,*
*115 pages, softcover $5.95*

Writers of Macintosh introductions are faced with an unusual problem—they are forced to describe what is essentially a visual computer. The best treatments, which rely heavily on depictions of the Mac's own high-resolution displays, more closely resemble gallery tours than the usual chapter-by-chapter narratives. *Presenting the Macintosh* is no exception. The authors' simple, readable introduction, although less technical than many other Macintosh titles, is spiced with humor that makes their narration of this particular gallery tour a congenial learning experience. The most attention is devoted to word processing. A general introduction precedes a chapter on the specific features of MacWrite, with emphasis on editing and formatting commands. The book concludes with some speculations about hardware and software enhancements. The one shortcoming of this otherwise effective introduction is the paradoxical objectivity of the authors in appraising the Macintosh compared with their unflinching subjectivity in plugging Dilithium software and books.

## The Best Book of: Lotus 1-2-3

*by Alan Simpson*
*Howard W. Sams, Indianapolis, 1984,*
*270 pages, softcover $12.95*

Despite the fact that Lotus Development Corporation has equipped its 1-2-3 with some of the best printed and disk-based documentation you'll see anywhere, Alan Simpson's clear, straightforward text is a valuable resource for anyone who wants to use the powerful integrated spreadsheet software to its fullest potential. The book is divided into sections covering the worksheet itself, graphics, database management, and macros. Although only 30 pages long, the section on graphics covers the full range of the program's capabilities in clear detail. When describing the programmable keystroke sequences known as macros, the author uses examples such as a macro-controlled slide show to highlight the power and convenience of the feature. If any reservation can be voiced about *The Best Book of: Lotus 1-2-3*, it is that careless editing—such as referencing a cell as AB instead of A8, or omitting the word "pointer" in "cell pointer"—sometimes makes the specifics of the text unnecessarily confusing. These, however, are minor flaws in a solid and informative volume. □


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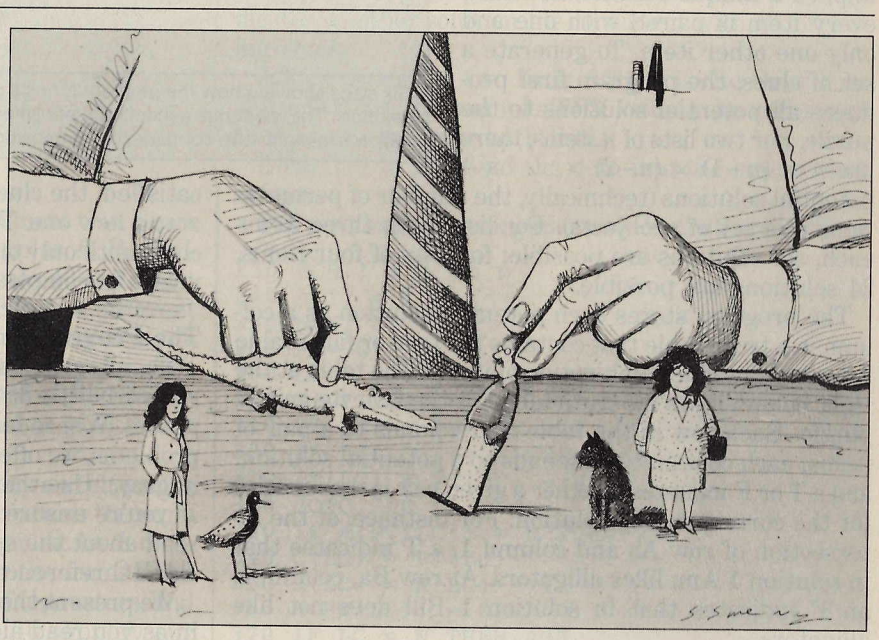
# The Matchmaker

*Create your own personalized logic puzzles*

by George Stewart



Have you tried any brain-teasers lately? Here's one to get you warmed up: If Ann likes alligators, then Cathy dislikes cats. If Cathy likes alligators, then Bill likes birds. If Ann dislikes alligators, then Cathy dislikes cats. If Cathy dislikes cats, then Bill likes alligators.

Assuming that no two individuals share the same favorite animal, match each person with his or her favorite animal.

Perhaps your tastes run toward mysteries. Here's one worthy of Agatha Christie: If the murderer does not have a blue pickup, then the postman has red hair. If the postman does not have a tattoo, then the milkman does not have a blue pickup. If the milkman does not have red hair, then the postman does not have white overalls.

But the plot thickens: If the murderer has a tattoo, then the garbageman has white overalls. If the garbageman does not have a tattoo, then the milkman does not have white overalls. If the garbageman does not have a blue pickup, then the postman has red hair. If the garbageman does not have a blue pickup, then the postman does not have red hair. Assuming that no two individuals share the same attribute, describe the murderer.

This month's program generates a never-ending succession of logic puzzles like these (for answers to both puzzles, see page 190). But you'll still control the topic and level of difficulty of the puzzles produced.

## How the Program Works

To generate puzzles, the program starts out with two lists that you provide. The first list consists of characters, and the second contains possessions or attributes. The favorite-animal puzzle is based on these lists:

| Character | Favorite Animal |
|---|---|
| Ann | alligators |
| Bill | birds |
| Cathy | cats |

Using this information, The Matchmaker formulates a set of clues known in formal logic as propositions. Propositions can take four forms (where *p* is known as the antecedent and *q* as the consequent):

*p implies q*
*not p implies q*
*p implies not q*
*not p implies not q*

In our puzzles, *p* stands for one pair of items from the

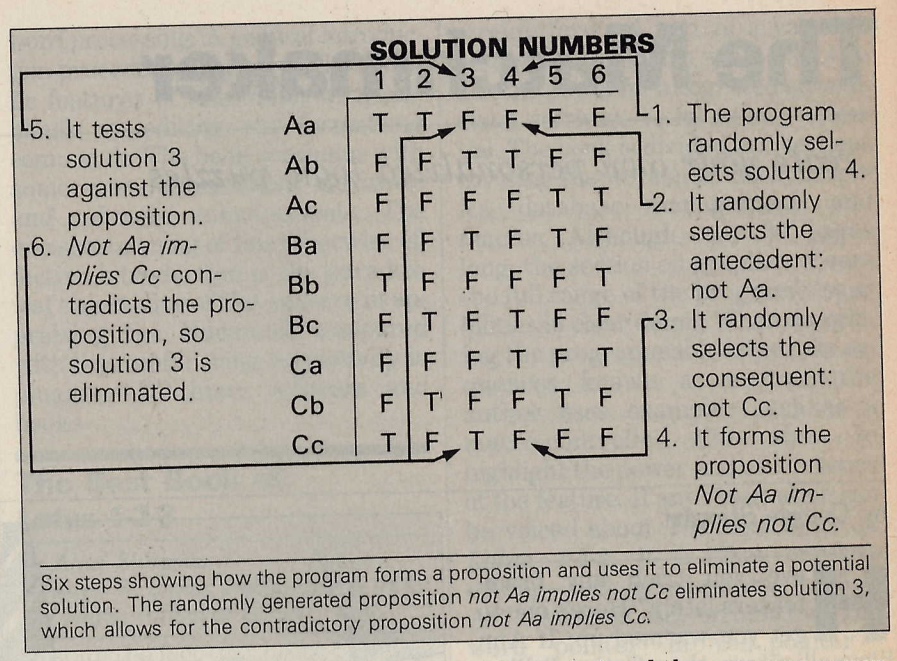
George Stewart is a contributing editor of *Popular Computing*.

Illustration by Steve Sweny

two lists, such as Ann and alligators, and $q$ stands for a different pair of items, say, Bill and cats. The logical operator *not* indicates that two items are not paired in the solution.

The favorite-animal puzzle includes all four types of propsitions. For example, *If Cathy likes alligators, then Bill likes birds* corresponds to *p implies q*. *If Cathy dislikes (does not like) cats, then Bill likes alligators* corresponds to *not p implies q*. Read through the puzzle again to identify the other two types.

For each puzzle, the set of clues implies a unique solution in which every item is paired with one and only one other item. To generate a set of clues, the program first produces all potential solutions to the puzzle. For two lists of $n$ items, there are $n \times (n-1) \times (n-2) \times \ldots \times 1$ potential solutions (technically, the number of permutations of a set of $n$ objects). For lists with three items each, six solutions are possible; for lists of four items, 24 solutions are possible.


SOLUTION NUMBERS
1 2 3 4 5 6
Aa T T F F F F
Ab F F T T F F
Ac F F F F T T
Ba F F T F T F
Bb T F F F F T
Bc F T F T F F
Ca F F F T F T
Cb F T F F T F
Cc T F T F F F
1. The program randomly selects solution 4.
2. It randomly selects the antecedent: not Aa.
3. It randomly selects the consequent: not Cc.
4. It forms the proposition Not Aa implies not Cc.
5. It tests solution 3 against the proposition.
6. Not Aa implies Cc contradicts the proposition, so solution 3 is eliminated.

Six steps showing how the program forms a proposition and uses it to eliminate a potential solution. The randomly generated proposition *not Aa implies not Cc* eliminates solution 3, which allows for the contradictory proposition *not Aa implies Cc*.

The program stores each potential solution as a column in a truth table that contains the true or false value for every possible combination of items. The table at the right below shows the truth table for the favorite-animal puzzle. Each row in the table corresponds to a pair of items; each column corresponds to a potential solution; and a T or F indicates whether a given pair is true or false for the corresponding solution. For instance, at the intersection of row Aa and column 1, a T indicates that in solution 1 Ann likes alligators. At row Ba, column 1, an F indicates that in solution 1 Bill does not like alligators.

Using the truth table, the program begins to generate a set of clues. First, it randomly selects a potential solution. From the corresponding solution column, the program randomly selects a pair. This pair become the antecedent in the proposition *p implies q*.

The program then randomly selects another pair from the same solution column. This pair becomes the consequent in the proposition *p implies q*. Putting the two pairs together, the program forms a proposition (see the figure above).

Before accepting the proposition or clue, the program checks to see if it meets two conditions. First, the clue must eliminate at least one potential solution. Second, the cumulative effect of the preceding clues and the latest one must leave at least one solution; otherwise the puzzle would be unsolvable. The table on the next page shows the effects of four clues on a list of potential solutions.

If both conditions are satisfied, the clue is accepted and the program continues. If either condition is not satisfied, the clue is discarded and the program generates a new one. The Matchmaker continues generating clues until only one solution remains. At that point, the puzzle is complete.

### The Program

The program is written in Microsoft BASIC and will run with little or no modification on most personal computers. Where language differences are likely to cause problems, we offer alternate program lines (highlighted in gray). Use them only if you can't use the main lines. If you're unsure about what works in your computer, read about the specific BASIC words involved in your BASIC reference manual.

We present the program in logical blocks. Type them in as you read along. The first block reads in the data lists and creates several arrays:

| | SOLUTION NUMBERS | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Aa | T | T | F | F | F | F |
| Ab | F | F | T | T | F | F |
| Ac | F | F | F | F | T | T |
| Ba | F | F | T | F | T | F |
| Bb | T | F | F | F | F | T |
| Bc | F | T | F | T | F | F |
| Ca | F | F | F | T | F | T |
| Cb | F | T | F | F | T | F |
| Cc | T | F | T | F | F | F |

The truth table showing all potential solutions to logic puzzles that use 3 items in each list.

```
10 REM   CLEAR SCREEN COMMAND
20 PRINT "THE MATCHMAKER"
30 PRINT
40 INPUT "ENTER A RANDOM NUMBER ";X
50 X = RND ( - ABS (X))
60 DATA 3
70 DATA IS NOT PAIRED WITH, IS PAIRED
     WITH
80 DATA A,B,C
90 DATA a,b,c
100 READ N
110 NS = 1
120 FOR I = 1 TO N
130 NS = NS * I
140 NEXT I
150 NC = N * N
160 DIM A(N), PT(N), K(N), C(N),
     T(NC,NS), F(NS,NS), FT(NS),
     P(NS,3), A$(2,N), TF$(2)
170 READ TF$(1),TF$(2)
180 FOR J = 1 TO 2
190 FOR K = 1 TO N
200 READ A$(J,K)
210 NEXT K
220 NEXT J
```

If possible, change line 10 to the statement that clears your computer screen (HOME for Applesoft BASIC, CLS for TRS-80 and IBM BASIC). Lines 40 and 50 let you set the random number "seed." Enter a different number each time you run the program; otherwise the program will generate the same set of clues for each puzzle. If your computer has a RANDOM or RANDOMIZE function to reset the random number seed, use it instead of line 40 and delete line 50.

Lines 60 to 90 determine the complexity and character of puzzles that are generated. Line 60 contains the number of items in each list; the number must be 3 or 4. Line 70 contains the verbs that relate the items from the two lists. Line 80 contains the list of characters, and line 90 contains the list of attributes. To simplify our discussion of the program, use the abstract data we've provided. After testing the program, you can personalize the puzzle by making up your own lists. If you cannot enter lowercase a, b, c in line 90, use 1, 2, 3 instead, and adapt our examples accordingly.

Lines 110 to 140 compute the number of potential solutions NS. This value depends on N, the number of items in each list. For N=3, NS=6; for N=4, NS=24. Line 150 computes the number of combinations of items from the two lists.

| | POTENTIAL SOLUTIONS | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Aa implies not Cc | F | T | T | T | T | T |
| Ca implies Bb | T | T | T | F | T | T |
| not Aa implies not Cc | T | T | F | T | T | T |
| not Cc implies Ba | T | F | T | F | T | F |

Effects of four clues on the potential-solution list. Solution 5 is the only one that is not eliminated.

Line 160 sets up the arrays. A( ), PT( ), K( ), and C( ) are used while the program generates NS potential solutions. T( , ) is a truth table representing these solutions. It corresponds to the table on page 184, bottom right. For example, T(2,3) indicates the true or false value for pair 2 in solution 3.

P( , ) stores the propositions, to be explained later on. F( , ) is a truth table indicating the results of each proposition; it corresponds roughly to the right side of the table below. For example, F(1,2) indicates whether proposition 1 is consistent with solution 2.

FT( ) is a truth table showing the cumulative effect of all preceding propositions. As an example, FT(1) indicates whether solution 1 is consistent with all preceding clues.

A$( , ) stores the two lists; A$(1,3) is the third item in the first list, for example. TF$( ) stores the verbs used to relate items from both lists.

Lines 170 to 220 read the data into the appropriate arrays.

The next logical block generates the truth table T( , ):

```
230 FOR I = 1 TO N
240 A(I) = 1
250 NEXT I
260 P = 0
270 LC = 1
280 A(PT(LC)) = 1
290 PT(LC) = PT(LC) + 1
300 IF PT(LC) <= N THEN 330
310 PT(LC) = PT(LC) - N
320 GOTO 300
330 IF A(PT(LC)) = 0 THEN 290
340 C(LC) = PT(LC)
350 K(LC) = K(LC) + 1
360 A(PT(LC)) = 0
370 IF LC = N THEN 400
380 LC = LC + 1
390 GOTO 290
400 P = P + 1
410 FOR I = 1 TO N
420 T((I - 1) * N + C(I),P) = 1
430 NEXT I
440 A(PT(LC)) = 1
450 K(LC) = 0
460 LC = LC - 1
470 IF LC = 0 THEN 500
480 IF K(LC) = N - LC + 1 THEN 440
490 GOTO 280
```

In lines 230 to 390, the program generates all combinations of the items in the second list: abc, acb, bac, bca, cab, and cba.

For each triplet, the program inserts A ahead of the first letter, B ahead of the second letter, and C ahead of the third letter. This gives us the following sequence of triplets: AaBbCc, AaBcCb, AbBaCc, AbBcCa, AcBaCb, and AcBbCa.

Each of these triplets constitutes a potential solution

to the logic puzzle. For instance, AaBbCc represents the solution: "A is paired with a, B with b, and C with c."

Lines 400 to 430 record the details of each solution in T( , ). Lines 440 to 490 set the program to generate the next combination of items, for example, acb.

After the truth table is completely filled in, the program can begin making logical propositions:

```
500 REM   CLEAR SCREEN COMMAND
510 PRINT "THE MATCHMAKER IS"
520 PRINT
530 PRINT "CONSTRUCTING A LOGIC PUZZLE"
540 PRINT
550 PRINT "FROM "N" DATA PAIRS."
560 PRINT
570 REM
580 PRINT "PLEASE WAIT."
590 REM
600 PO = 0
610 QO = 0
620 FC = 0
630 PN = 0
640 FOR I = 1 TO NS
650 FT(I) = 1
660 NEXT I
```

In lines 640 to 660, the array FT( ) is filled with 1s, indicating that no solution has been ruled out yet.

The next lines randomly select a proposition:

```
670 G = INT ( RND (1) * NS) + 1
680 P = INT ( RND (1) * NC) + 1
690 Q = INT ( RND (1) * NC) + 1
700 P1 = INT ((P - 1) / N) + 1
710 P2 = P - (P1 - 1) * N
720 Q1 = INT ((Q - 1) / N) + 1
730 Q2 = Q - (Q1 - 1) * N
740 IF (P1 = Q1) OR (P2 = Q2) THEN 670
750 PV = T(P,G)
760 QV = T(Q,G)
770 IF (PV = PO) AND (QV = QO) THEN 670
780 PN = PN + 1
790 P(PN,1) = G
800 P(PN,2) = P
810 P(PN,3) = Q
```

The function RND(1) returns a random value greater than or equal to 0 and less than 1. Lines 670 to 690 randomly select solution G, antecedent pair P, and consequent pair Q. G ranges from 1 to NS (the number of solutions); P and Q range from 1 to NC (the number of combinations). IBM BASIC uses RND in place of RND(1). Some versions of TRS-80 BASIC use RND(0) in place of RND(1). Check the form your computer uses and make the necessary changes in lines 670 to 690.

Lines 700 and 710 break P into two numbers P1 and P2, corresponding to the items it represents from lists 1 and 2. For example, P=6 breaks down into P1=2, P2=3 and represents the pair item 2, list 1 and item 3, list 2. Lines 720 and 730 accomplish a similar function for Q, Q1, and Q2.

At this point, we have an antecedent pair P1-P2 and a consequent pair Q1-Q2. Typical values might be Ab and Bc, producing clues like: *If A-b then B-c*. However, duplicate pairs like Ab and Ab will produce useless propositions such as *If A-b, then A-b*. Even if the two pairs have just one item in common, as in Ab-Cb, the proposition will also be useless, as in *If A-b, then C-b*. (Two items from list 1 cannot share an item from list 2.) Line 740 eliminates all such "weak" clues.

Lines 750 and 760 get the truth values of P1-P2 and Q1-Q2 for solution G. The truth table entries T(P,G) and T(Q,G) contain this information. Line 770 compares the current proposition with the previous one. If both have the same form, then the current proposition is rejected and a new one is selected.

At this point, the proposition has passed first inspection. Lines 780 to 810 increment the proposition counter and store the latest proposition in the array P( , ).

Now The Matchmaker tests the effects of the latest clue on each potential solution:

```
820 FOR I = 1 TO NS
830 PT = T(P,I)
840 QT = T(Q,I)
850 IF PV < > PT THEN 890
860 IF QV = QT THEN 890
870 F(PN,I) = 0
880 GOTO 900
890 F(PN,I) = 1
900 NEXT I
910 FA = 0
920 FOR I = 1 TO NS
930 IF FT(I) = 1 AND F(PN,I) = 0 THEN FA
    = FA + 1
940 NEXT I
950 IF FA > 0 THEN 980
960 PN = PN - 1
970 GOTO 670
980 IF FA + FC >= NS THEN 620
```

For each potential solution, the program examines the truth values PT, QT of the pairs P1-P2 and Q1-Q2 (lines 820 to 840). It compares these with the truth values PV, QV of the latest clue (lines 850 and 860). If PT=PV and QT=QV, then the solution is consistent with the latest clue. The result is stored in array F( , ) (line 870).

Lines 910 to 960 determine whether the latest clue has eliminated any solutions. FA counts the number of solutions ruled out by the latest clue. If FA=0, the latest clue is redundant, so the program rejects it by decrementing the proposition counter in line 960 and going back to line 670 for a new clue.

Line 980 ensures that at least one solution remains possible after the latest clue. FC counts the total number of solutions eliminated by previous clues. FA+FC gives the total eliminated when the latest clue is taken into account. If the sum equals or exceeds the number of solutions NS, then the puzzle is unsolvable. In that case, the program erases the entire sequence of propositions and starts over by going back to line 620.

After passing all these hurdles, the clue is finally accepted:

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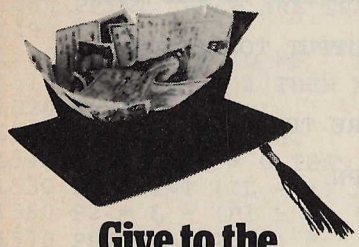

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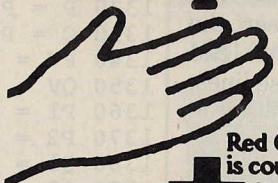

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```
990 FC = FA + FC
1000 FOR I = 1 TO NS
1010 IF F(PN,I) = 0 THEN FT(I) = 0
1020 NEXT I
1030 IF FC = NS - 1 THEN 1070
1040 PO = PV
1050 QO = QV
1060 GOTO 670
```

Line 990 updates the counter FC for solutions eliminated. Lines 1000 to 1020 update the cumulative truth table F( ). Line 1030 determines whether the puzzle is complete. When FC=NS−1, only one solution remains. If more than one solution remains, lines 1040 and 1050 record the latest truth values so they will not be repeated in the next clue.

The following lines let you select the output device for the puzzle:

```
1070 REM   CLEAR SCREEN COMMAND
1080 PRINT "THE PUZZLE IS READY."
1090 PRINT
1100 REM
1110 REM   GIVE THE OPTION OF ROUTING
1120 REM   THE PUZZLE INFORMATION
1130 REM   TO THE PRINTER OR CRT
1140 REM
1150 REM   CLEAR SCREEN COMMAND
```

Insert your computer's clear-screen command in line 1050, or leave the remark as is. If your computer can route output from the monitor to the printer, insert the appropriate commands in lines 1100 to 1140. For IBM or Microsoft BASIC in a CP/M system, use these lines:

```
1100 PRINT "OUTPUT TO: 1-CRT 2-PRINTER"
1110 INPUT "ENTER 1 OR 2 ";SL
1120 SL$=" "
1130 IF SL=2 THEN SL$=CHR$(16)
1140 PRINT SL$
```

If you select printer output, SL$ contains a Control-P character, which controls a printer echo function that copies display data to the printer. Line 1140 turns the printer echo on.

In Applesoft BASIC, use these lines:

```
1100 PRINT "SLOT NUMBER OF OUTPUT DEVICE (0-7)"
1110 PRINT "ENTER 0 FOR CRT ";
1120 SL$=" ": REM NO SPACE BETWEEN QUOTES
1130 IF SL < 0 or SL > 7 THEN 1100
1140 PRINT CHR$ (4) "PR#" STR$ (SL)
```

Line 1140 causes the Apple to route output to the device connected to slot number SL.

If these suggestions for routing don't work with your computer, look in your BASIC manual for commands that route the input and output data from one device to another. If your computer doesn't have the routing capability, leave lines 1100 to 1140 as remarks and change PRINT to LPRINT in the lines that print the puzzle information (we'll call your attention to them in the following blocks).

Before printing any clues, the program prints the two lists so you'll know what items are to be matched:

```
1160 PRINT "MATCH COLUMN A WITH COLUMN
     B"
1170 PRINT
1180 PRINT "A" TAB( 8) "(" TF$(2) ")"
     TAB( 30) "B"
1190 PRINT
1200 FOR J = 1 TO N
1210 PRINT A$(1,J) TAB( 30) A$(2,J)
1220 NEXT J
1230 PRINT
```

If you aren't using an output routing capability, you may be able to get a printout by changing PRINT to LPRINT in lines 1160 to 1230.

The next block of lines prints the clues:

```
1240 REM   RESTORE OUTPUT TO CRT
1250 INPUT "PRESS RETURN TO SEE YOUR
     CLUES";EN$
1260 REM   ROUTE OUTPUT TO SELECTED
     DEVICE
1270 PRINT
1280 PRINT "HERE ARE THE CLUES..."
1290 PRINT
1300 FOR J = 1 TO PN
1310 G = P(J,1)
1320 P = P(J,2)
1330 Q = P(J,3)
1340 PV = T(P,G)
1350 QV = T(Q,G)
1360 P1 = INT ((P - 1) / N) + 1
1370 P2 = P - (P1 - 1) * N
1380 Q1 = INT ((Q - 1) / N) + 1
1390 Q2 = Q - (Q1 - 1) * N
1400 PRINT "IF " A$(1,P1) " " TF$(PV +
     1) " " A$(2,P2)
1410 PRINT "THEN " A$(1,Q1) " " TF$(QV +
     1) " " A$(2,Q2) "."
1420 PRINT
1430 NEXT J
```

If applicable to your computer, line 1240 restores output to the screen so the continuation menu will appear on the screen and not on the printout. Line 1260 routes output back to the printer. In IBM and Microsoft BASIC under CP/M, make these changes:

```
1240 PRINT SL$
1260 PRINT SL$
```

In Applesoft BASIC make these changes:

```
1240 PRINT CHR$ (4) "PR#0"
1260 PRINT CHR$ (4) "PR#" STR$ (SL)
```

If you don't have output routing, change PRINT to LPRINT in lines 1270 to 1420 for a printout.

In lines 1300 to 1420, the program reconstructs each

clue by cross-referencing P( , ) and T( , ). Let's take clue 1 for an example. G=P(1,1) stores the solution column number from which the clue was drawn. P=P(1,2) and Q=P(1,3) store the rows corresponding to the antecedent and consequent pairs. Therefore, PV=T(P,G) gives the truth value of the antecedent, and QV=T(Q,G) gives the truth value of the consequent. For example, assume G=4, P=1, and Q=9. Reading PV and QV from the first table, we get the clue *not Aa implies not Cc.*

Lines 1400 to 1430 print the clue in more conversational form, using the verbs provided in line 70. Notice the single space inside the double quotes in lines 1400 and 1410.

After printing all the clues, the program offers to give the answers:

```
1440 REM   RESTORE OUTPUT TO CRT
1450 INPUT "PRESS RETURN TO SEE THE
     ANSWERS";EN$
1460 REM   ROUTE OUTPUT TO SELECTED
     DEVICE
1470 PRINT
1480 PRINT "HERE ARE THE ANSWERS..."
1490 PRINT
1500 FOR I = 1 TO NS
1510 IF FT(I) = 1 THEN X = I
1520 NEXT I
1530 FOR L = 1 TO NC
1540 IF T(L,X) = 0 THEN 1580
1550 P1 = INT ((L - 1) / N) + 1
1560 P2 = L - (P1 - 1) * N
1570 PRINT A$(1,P1) " " TF$(2)" "
     A$(2,P2)
1580 NEXT L
1590 PRINT
1600 GOSUB 1720: REM   PRINT
     COMBINATIONS
1610 PRINT
1620 GOSUB 1880: REM   PRINT SOLUTION
     WORKSHEET
```

If applicable to your computer, line 1440 restores output to the screen so the continuation menu will appear on the screen and not on the printout. Line 1460 routes output back to the printer.

In IBM BASIC and Microsoft BASIC under CP/M, make these changes:

```
1440 PRINT SL$
1460 PRINT SL$
```

In Applesoft BASIC make these changes:

```
1440 PRINT CHR$ (4) "PR#0"
1460 PRINT CHR$ (4) "PR#" STR$ (SL)
```

In lines 1500 to 1520, the program recovers the solution by examining each element of FT( ) to find the element that equals 1. The subscript of that element is the solution number.

Lines 1530 to 1580 go through each row of the truth table, looking only at column X (the solution column). If the truth value at that row-column intersection is 0 (for false), the program skips to the next row. Whenever it finds a 1 (for true), it prints the pair in conversational form. Any given solution column will have only N true pairs, resulting in N positive statements of the form *P1-P2 is paired with Q1-Q2.* Notice the single space inside the double quotes in line 1570.

Lines 1600 and 1620 call subroutines that you might find helpful for testing the program.

The following lines give you three choices: reprint the same puzzle, create a new puzzle, or quit:

```
1630 REM   RESTORE OUTPUT TO CRT
1640 PRINT
1650 REM
1660 PRINT "ENTER 1 TO REVIEW PUZZLE"
1670 PRINT "       2 FOR NEW PUZZLE"
1680 PRINT "       3 TO END"
1690 INPUT S
1700 ON S GOTO 1070,500,1710
1710 END
```

If applicable to your computer, line 1630 restores output to the screen so the continuation menu will appear on the screen and not on the printout.

In IBM BASIC and Microsoft BASIC under CP/M, make this change:

```
1630 PRINT SL$
```

In Applesoft BASIC, make this change:

```
1630 PRINT CHR$ (4) "PR#0"
```

Finally, here are the subroutines for testing, debugging, and experimenting. If you don't have routing, change the PRINT statement to LPRINT in lines 1720 to 2130 for a printout. The first subroutine prints the table of possible solutions:

```
1720 PRINT "HERE ARE ALL THE VALID
     COMBINATIONS"
1730 PRINT
1740 PRINT
1750 FOR LZ = 1 TO NC
1760 Z1 = INT ((LZ - 1) / N) + 1
1770 Z2 = LZ - (Z1 - 1) * N
1780 PRINT CHR$ (64 + Z1); CHR$ (96 +
     Z2) TAB( 5)
1790 FOR PZ = 1 TO NS
1800 IF T(LZ,PZ) = 0 THEN 1830
1810 PRINT "T";
1820 GOTO 1840
1830 PRINT "F";
1840 NEXT PZ
1850 PRINT
1860 NEXT LZ
1870 RETURN
```

The second subroutine prints the solution worksheet:

```
1880 PRINT "HERE IS THE SOLUTION
     WORKSHEET"
1890 PRINT
1900 FOR IZ = 1 TO PN
1910 GZ = P(IZ,1)
1920 PZ = P(IZ,2)
1930 QZ = P(IZ,3)
1940 PX = T(PZ,GZ)
1950 QX = T(QZ,GZ)
1960 IF PX = 0 THEN C1$ = "~"
1970 IF PX = 1 THEN C1$ = " "
1980 IF QX = 0 THEN C2$ = "~"
1990 IF QX = 1 THEN C2$ = " "
2000 Z1 = INT ((PZ - 1) / N) + 1
2010 Z2 = PZ - (Z1 - 1) * N
2020 Z3 = INT ((QZ - 1) / N) + 1
2030 Z4 = QZ - (Z3 - 1) * N
2040 P$ = CHR$ (64 + Z1) + CHR$ (96 +
     Z2)
2050 Q$ = CHR$ (64 + Z3) + CHR$ (96 +
     Z4)
2060 PRINT C1$ P$ "=>" C2$ Q$ TAB( 10);
2070 FOR JZ = 1 TO NS
2080 IF F(IZ,JZ) = 0 THEN 2110
2090 PRINT "T";
2100 GOTO 2120
2110 PRINT "F";
2120 NEXT JZ
2130 PRINT
2140 NEXT IZ
2150 RETURN
```

Note the single space inside the double quotes in lines 1970 and 1990.

**Testing the Program**

After typing in the entire program, run it. Eliminate any obvious typing errors you may have made. If you use the data provided in lines 60 to 90, the first puzzle generated will resemble the following, although the clues and answers will vary because they are randomly determined:

If B is paired with c, then A is not paired with a. If B is not paired with b, then C is not paired with a. If A is not paired with a, then B is paired with c.

Answers will be something like this: A is paired with a. B is paired with b. C is paired with c.

If you use the testing subroutines in 1720 to 2150, the program will print out a truth table similar to the one at the bottom of page 184. It will also print a solution worksheet similar to the one shown at the bottom of page 185. The letters A, B, and C are used in place of the items in list 1; the letters a, b, and c are used in place of the items in list 2. The symbol ~ stands for *not* and the symbol => stands for *implies*. Accordingly, *Bc => ~Aa* is shorthand for *If B is paired with c, then A is not paired with a.* When the program is running properly, you can delete lines 1600 and 1620, which call the troubleshooting subroutines. On the other hand, you might want to leave them in so the program can serve as a logic tutor.

**Personalizing the Program**

When you're ready to begin generating personalized puzzles, change lines 60 to 90 to suit your preferences.

First decide whether to include three or four items in each list; lists of four items will produce more difficult puzzles.

When you make up the items for each list, use characters in list 1 (line 80) and attributes in list 2 (line 90). To make things easier to keep track of, start with attributes that are mutually exclusive, such as red hair, black hair, and blond hair.

Finally, select the verbs that will indicate whether a given pair is true or not. Use verbs with opposing meanings, such as dislikes/likes, is not/is, or does not have/has. Store the two verbs in line 70, and be sure to put the negative verb first.

Experiment! By choosing the list items carefully, you can come up with some interesting puzzles. Remember to use a different random number each time you run the program to generate a different series of clues.

To get you started, here are the data lines used to generate the puzzles at the beginning of this article.

Favorite animals:

```
60 DATA 3
70 DATA dislikes, likes
80 DATA Ann, Bill, Cathy
90 DATA alligators, birds, cats
```

Describe the murderer:

```
60 DATA 4
70 DATA does not have, has
80 DATA The murderer, The milkman, The postman, The garbageman
90 DATA white overalls, a tattoo, red hair, a blue pickup
```

□

**Answers to Puzzles:**

Favorite animals: Ann likes cats. Bill likes alligators. Cathy likes birds.

Describe the murderer: The murderer has white overalls. The milkman has a tattoo. The postman has red hair. The garbageman has a blue pickup.

Do you have questions regarding this program or suggestions for future projects? Send them to: George Stewart, The Program Factory, R.F.D. #1, Box 802, Hancock, NH 03449. Include a stamped, self-addressed envelope if you want a reply. For programming questions, include a program listing, a sample run, and a brief description of your problem.

**Editor's Note:** George Stewart's book *The Apple Program Factory* (Osborne/McGraw-Hill, 1984, $11.95) is a collection of 20 programming projects, most of which have appeared in these pages. All of the programs are written specifically for computers with Applesoft BASIC and make use of features like graphics, disk files, and sound. Other Program Factory books are on the way as well, including collections for the Commodore 64, IBM PC, and TRS-80 computers.

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4) When AIMS Says: "Enter Subscriber Number" . . .
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Enter [2][#][8][4][#][#]

**ENTER YOUR INQUIRIES . . .**

6a) When AIMS Says "Enter (Next) Inquiry Number" . . .
Enter One Inquiry Selection From Below . . . (Ignore Blank Boxes)
b) Repeat 6a As Needed (Maximum 17 Inquiry Numbers)

| | | |
|---|---|---|
| 1. ☐☐☐[#][#] | 6. ☐☐☐[#][#] | 10. ☐☐☐[#][#] | 14. ☐☐☐[#][#] |
| 2. ☐☐☐[#][#] | 7. ☐☐☐[#][#] | 11. ☐☐☐[#][#] | 15. ☐☐☐[#][#] |
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**END SESSION . . .**

7) End Session By Entering . . .
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| 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 92 | 102 | 112 | 122 | 132 | 142 | 152 | 162 | 172 | 182 | 192 | 202 | 212 | 222 | 232 | 242 | 252 | 262 | 272 | 282 | 292 |
| 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 | 103 | 113 | 123 | 133 | 143 | 153 | 163 | 173 | 183 | 193 | 203 | 213 | 223 | 233 | 243 | 253 | 263 | 273 | 283 | 293 |
| 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 94 | 104 | 114 | 124 | 134 | 144 | 154 | 164 | 174 | 184 | 194 | 204 | 214 | 224 | 234 | 244 | 254 | 264 | 274 | 284 | 294 |
| 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 | 105 | 115 | 125 | 135 | 145 | 155 | 165 | 175 | 185 | 195 | 205 | 215 | 225 | 235 | 245 | 255 | 265 | 275 | 285 | 295 |
| 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96 | 106 | 116 | 126 | 136 | 146 | 156 | 166 | 176 | 186 | 196 | 206 | 216 | 226 | 236 | 246 | 256 | 266 | 276 | 286 | 296 |
| 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 | 107 | 117 | 127 | 137 | 147 | 157 | 167 | 177 | 187 | 197 | 207 | 217 | 227 | 237 | 247 | 257 | 267 | 277 | 287 | 297 |
| 18 | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98 | 108 | 118 | 128 | 138 | 148 | 158 | 168 | 178 | 188 | 198 | 208 | 218 | 228 | 238 | 248 | 258 | 268 | 278 | 288 | 298 |
| 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 | 109 | 119 | 129 | 139 | 149 | 159 | 169 | 179 | 189 | 199 | 209 | 219 | 229 | 239 | 249 | 259 | 269 | 279 | 289 | 299 |
| 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 | 300 |

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| Fair | 3 | 7 | 11 | 15 | 19 | 23 | 27 | 31 | 35 | 39 | 43 | 47 | 51 |
| Poor | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 |

| Article no. | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
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| Excellent | 53 | 57 | 61 | 65 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 |
| Good | 54 | 58 | 62 | 66 | 70 | 74 | 78 | 82 | 86 | 90 | 94 | 98 |
| Fair | 55 | 59 | 63 | 67 | 71 | 75 | 79 | 83 | 87 | 91 | 95 | 99 |
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| 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 | 103 | 113 | 123 | 133 | 143 | 153 | 163 | 173 | 183 | 193 | 203 | 213 | 223 | 233 | 243 | 253 | 263 | 273 | 283 | 293 |
| 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 94 | 104 | 114 | 124 | 134 | 144 | 154 | 164 | 174 | 184 | 194 | 204 | 214 | 224 | 234 | 244 | 254 | 264 | 274 | 284 | 294 |
| 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 | 105 | 115 | 125 | 135 | 145 | 155 | 165 | 175 | 185 | 195 | 205 | 215 | 225 | 235 | 245 | 255 | 265 | 275 | 285 | 295 |
| 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96 | 106 | 116 | 126 | 136 | 146 | 156 | 166 | 176 | 186 | 196 | 206 | 216 | 226 | 236 | 246 | 256 | 266 | 276 | 286 | 296 |
| 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 | 107 | 117 | 127 | 137 | 147 | 157 | 167 | 177 | 187 | 197 | 207 | 217 | 227 | 237 | 247 | 257 | 267 | 277 | 287 | 297 |
| 18 | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98 | 108 | 118 | 128 | 138 | 148 | 158 | 168 | 178 | 188 | 198 | 208 | 218 | 228 | 238 | 248 | 258 | 268 | 278 | 288 | 298 |
| 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 | 109 | 119 | 129 | 139 | 149 | 159 | 169 | 179 | 189 | 199 | 209 | 219 | 229 | 239 | 249 | 259 | 269 | 279 | 289 | 299 |
| 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 | 300 |

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| 5 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 | 105 | 115 | 125 | 135 | 145 | 155 | 165 | 175 | 185 | 195 | 205 | 215 | 225 | 235 | 245 | 255 | 265 | 275 | 285 | 295 |
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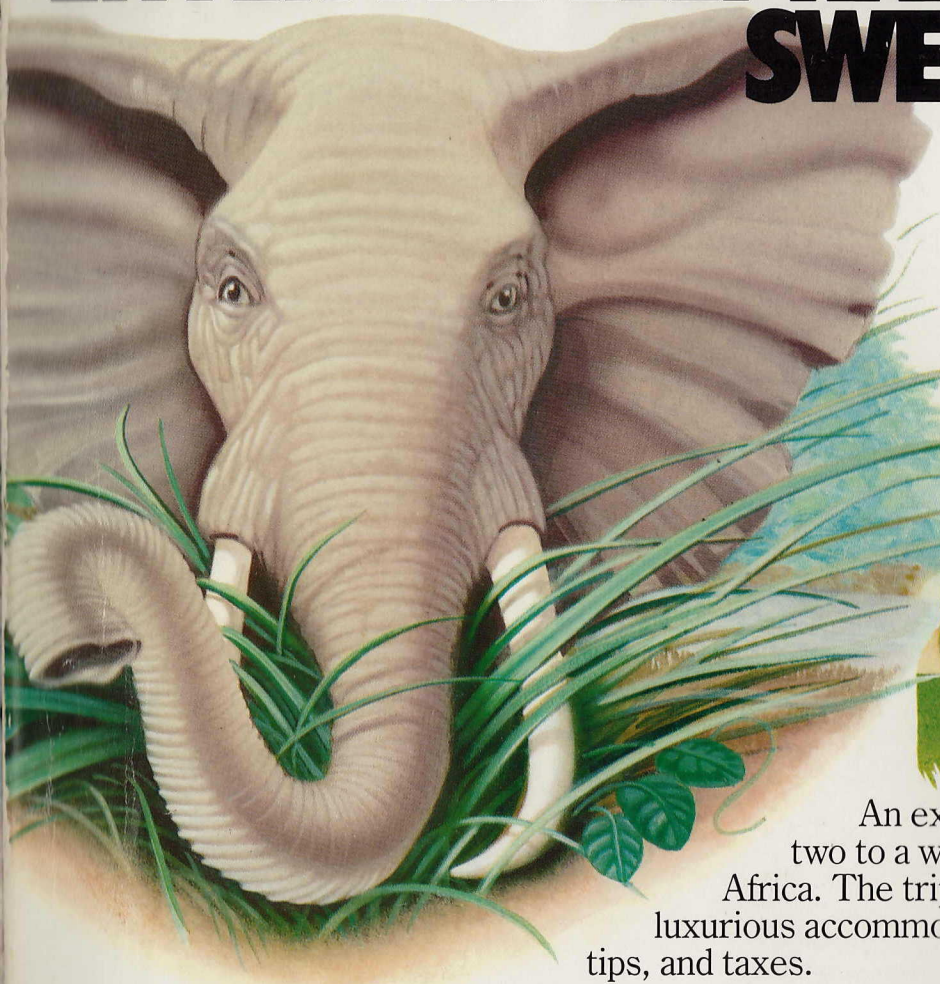

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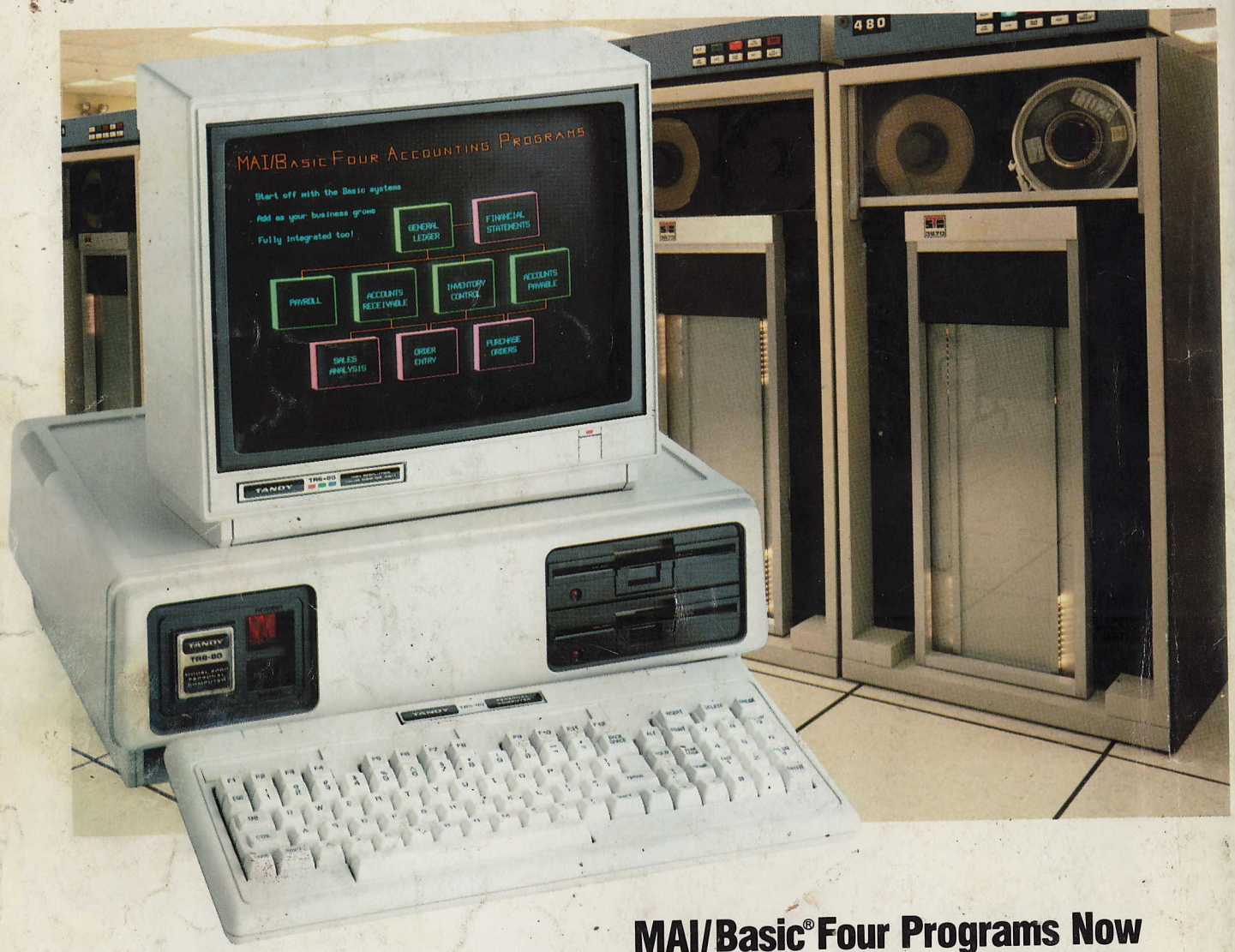


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